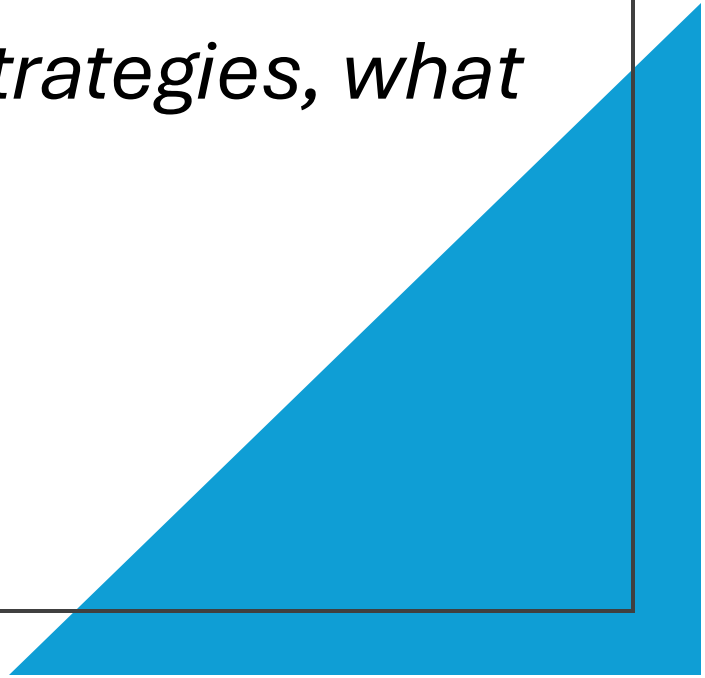


While we are getting started...

We would like to hear from you! In the chat please share:

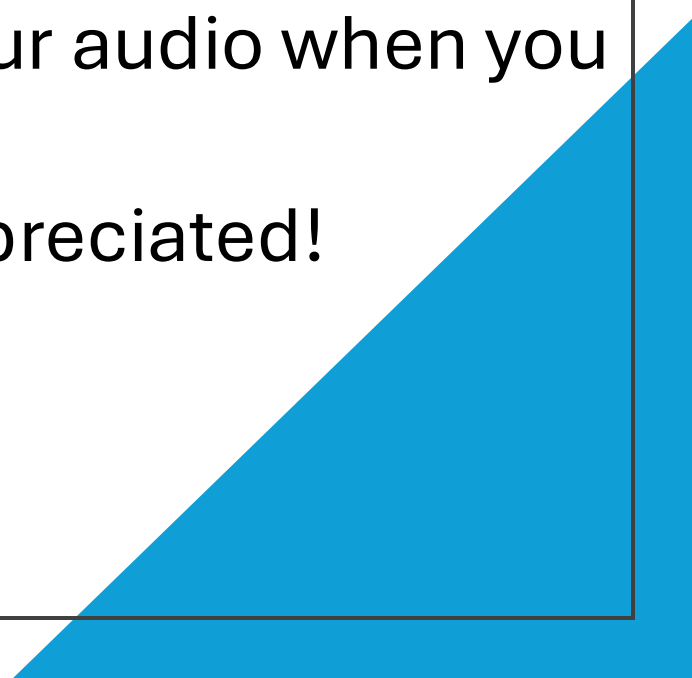
When you hear the phrase nature-based strategies, what comes to mind?



Agenda:

1. Foundations
2. Habitat protection
3. Green & grey
4. Shoreline stabilization
5. Case studies
6. Getting out of harm's way
7. Questions

Meeting Reminders:

- This meeting is being recorded, if you would like to keep your camera off
 - Please mute your audio when you are not talking
 - Feedback is appreciated!
- 

Natural Hazards 101 Series

Session #6: Demystifying Nature-Based Strategies

February 25, 2025



Riparian Buffer



Institute of Natural Resources

Rain garden and bioswale



City of Vancouver, CAN

Barrier island



NC Coastal Land Trust

Plant restoration



NOAA

Permeable pavers

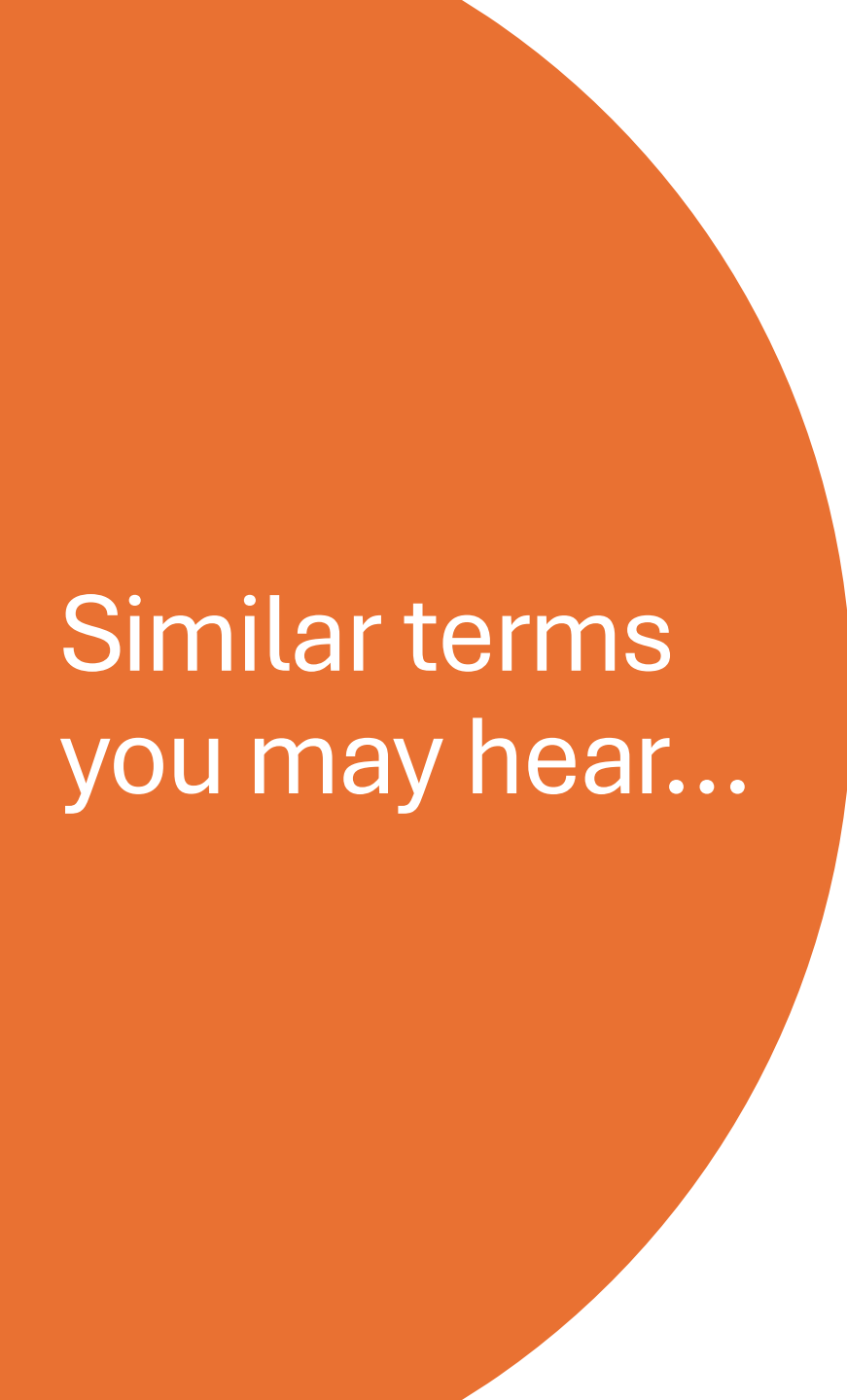


R.I. Lampus

Natural materials in erosion control



Ashley Charleson / Brunswick, ME



Similar terms
you may hear...

- Nature-based solutions
 - Green infrastructure
 - Engineering with nature
 - Nature-by-design
 - Nature-based engineering
 - Living shorelines
 - Natural climate solutions
 - Low impact development
 - Eco-design
- 



Definition

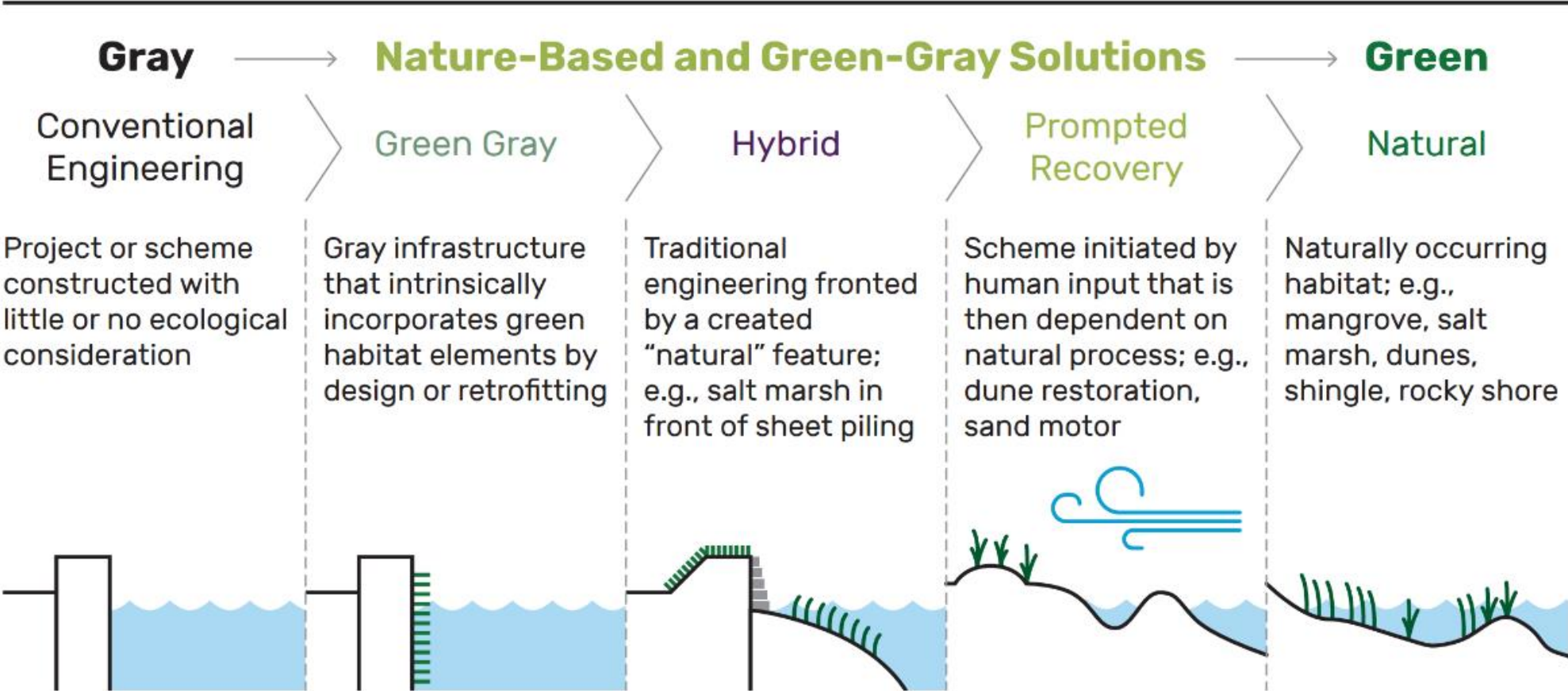
Actions for our natural and built environment

that address societal challenges i.e., natural hazards

While benefiting both humans and nature

General Framework: From US Army Corps of Engineers

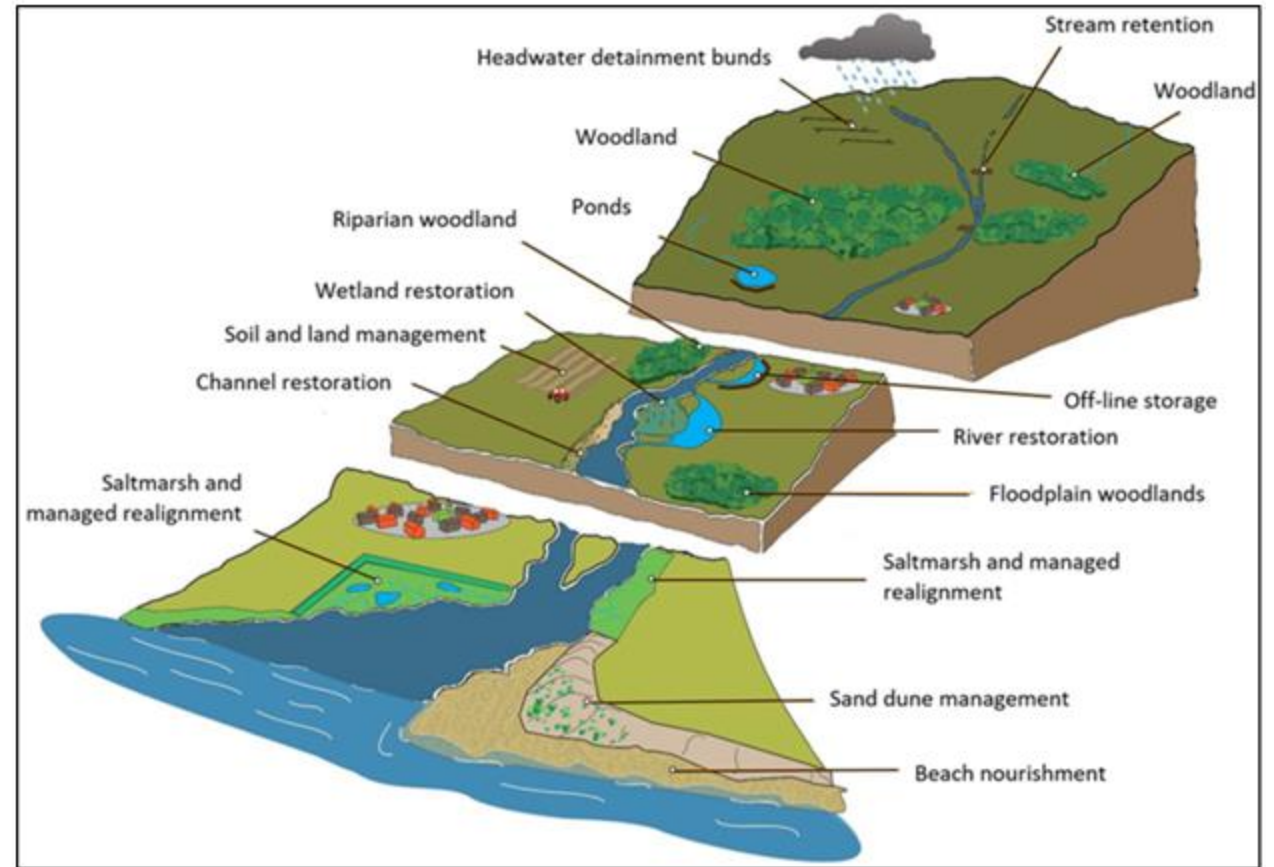
Figure 14.5. Continuum of Nature-Based Techniques Used in Practice, from Simple Additions to Existing Infrastructure to More Elaborate Schemes Incorporating a Suite of Nature-Based Elements



Bridges, T. S., J. K. King, J. D. Simm, M. W. Beck, G. Collins, Q. Lodder, and R. K. Mohan, eds. 2021. International Guidelines on Natural and Nature-Based Features for Flood Risk Management. Vicksburg, MS: U.S. Army Engineer Research and Development Center. p. 707.

Regional Nature-Based Strategies

- Connectivity of nature and the water cycle
- Site specific vs. system-wide
- Incremental vs. transformational



Griffiths, J.; Borne, K.E.; Semadeni-Davies, A.; Tanner, C.C. Selection, Planning, and Modelling of Nature-Based Solutions for Flood Mitigation. *Water* 2024, 16, 2802. <https://doi.org/10.3390/w16192802>

Master Nature-Based Planning



Above: Salata, S.; Arslan, B. Designing with Ecosystem Modelling: The Sponge District Application in 'Izmir, Turkey. Sustainability 2022, 14, 3420. <https://doi.org/10.3390/su14063420>

Right: City of Dublin, OH Metro Area Strategic Plan by Sasaki Associates, Inc.

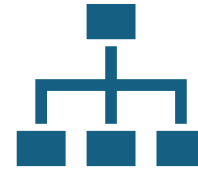
Considerations for today's presentation...



What are my short and long-term goals?



What types of NBSs may fit the timeframe of these goals?



How may these, or other, NBSs be incorporated in my projects?



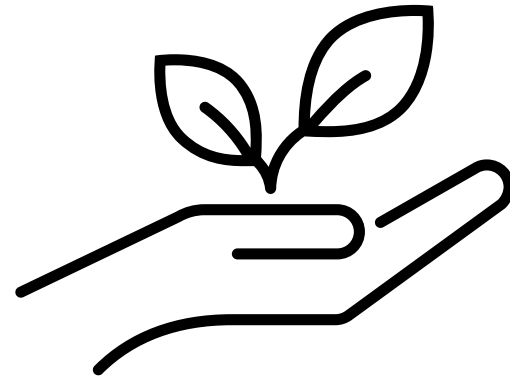
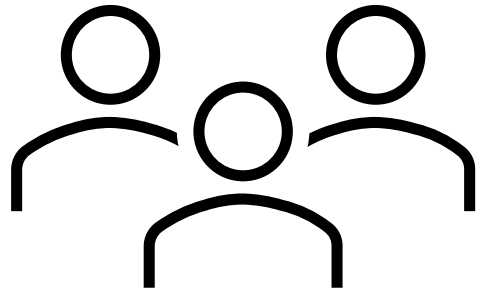
What level of risk are we comfortable with?

Demystifying Nature-Based Strategies

Helena Tatgenhorst
Coastal Program Manager

The Nature
Conservancy 
Maine

What are NBS?



Why use NBS?

HARDENED SHORELINES

- Seawalls, levees, etc.
- Short-term solution
- Damage ecosystems
- Prevent shoreline access
- Negative impacts on neighbors

NATURAL SHORELINES

- Salt marshes, dunes, beaches
- Strengthen over long term
- Healthy ecosystems adapt to change
- Access to shoreline and nature
- Wide-reaching benefits

Types of NBS

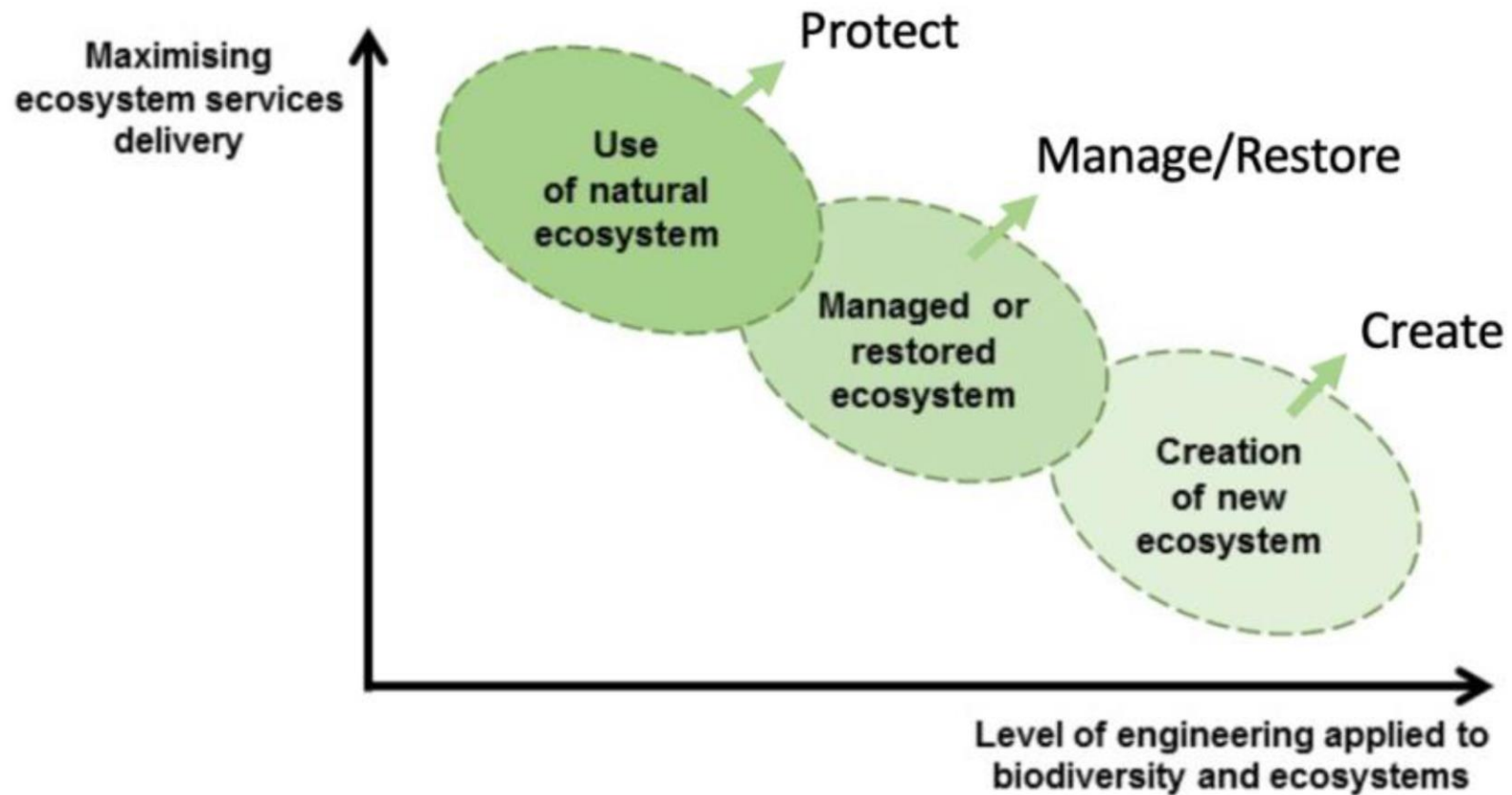
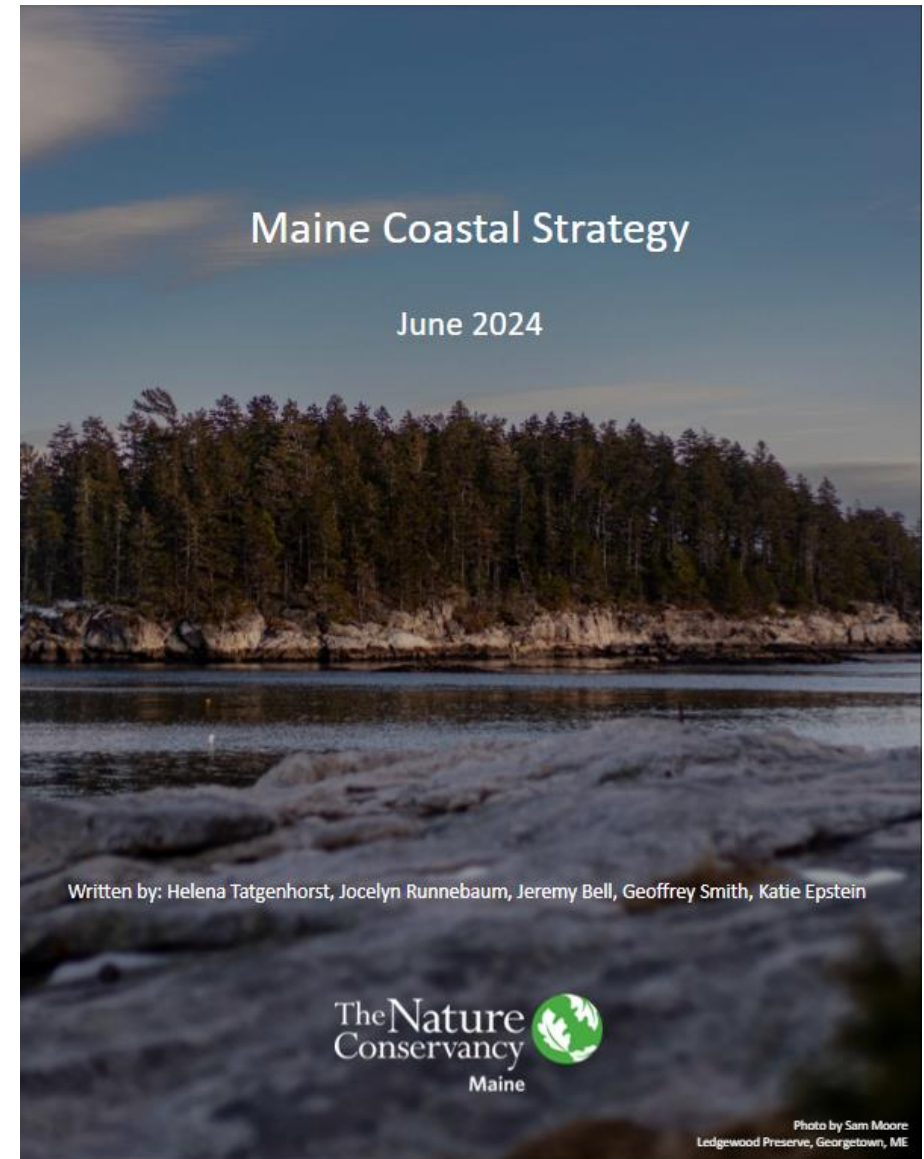


Figure adapted from Eggermont et al., 2015

How does The Nature Conservancy engage in NBS?



Climate resilient tidal marshes

- Develop the **Maine Tidal Marsh Restoration Network**
- Engage with the **Maine Blue Carbon Network**

Photo by Helena Tatgenhorst
Sprague Marsh, Phippsburg, ME



Climate Resilient shellfish beds

- Build a Shellfish Restoration Community of Practice
- Develop a permitting system for shellfish restoration
- Develop a Maine shellfish purchase program



Climate resilient Eelgrass Beds

- Engage with the **Maine Seagrass Consortium**
- Develop and mobilize funding for additional research
- Increase state capacity for eelgrass bed monitoring
- Explore opportunities for eelgrass restoration as appropriate

Thank you

Helena Tatgenhorst

h.tatgenhorst@tnc.org

The Nature
Conservancy 
Maine

CoastWise

An Approach to Tidal Road Crossing Design

Bobby van Riper
Coastal Habitat Restoration Specialist
Maine Coastal Program
Robert.vanriper@maine.gov





The CoastWise Approach was developed for **road owners, municipal staff, engineers**, and other people interested in helping to **replace tidal road culverts and bridges** with **safe, climate resilient crossings** – CoastWise is a Team effort!

Link:

<https://www.maine.gov/dmr/programs/maine-coastal-program/coastal-community-support/the-coastwise-approach>

112 Pages!

Contributors to the Development of CoastWise





What is CoastWise?

- A guidance document for resilient tidal road crossing replacement.
- A guidance document for salt marsh rehabilitation.
- A source of contacts for questions.
- A primer on Salt Marsh ecology and function.

Tidal restoration projects are a TEAM effort





A Salt Marsh with a 'causeway'

Culvert and causeway











Why are salt marshes important?

- They capture and retain atmospheric carbon.
- They act as a 'shock absorber' for storm surge.
- They capture and process runoff from land.
- They add more 'biological material' than any other single habitat.

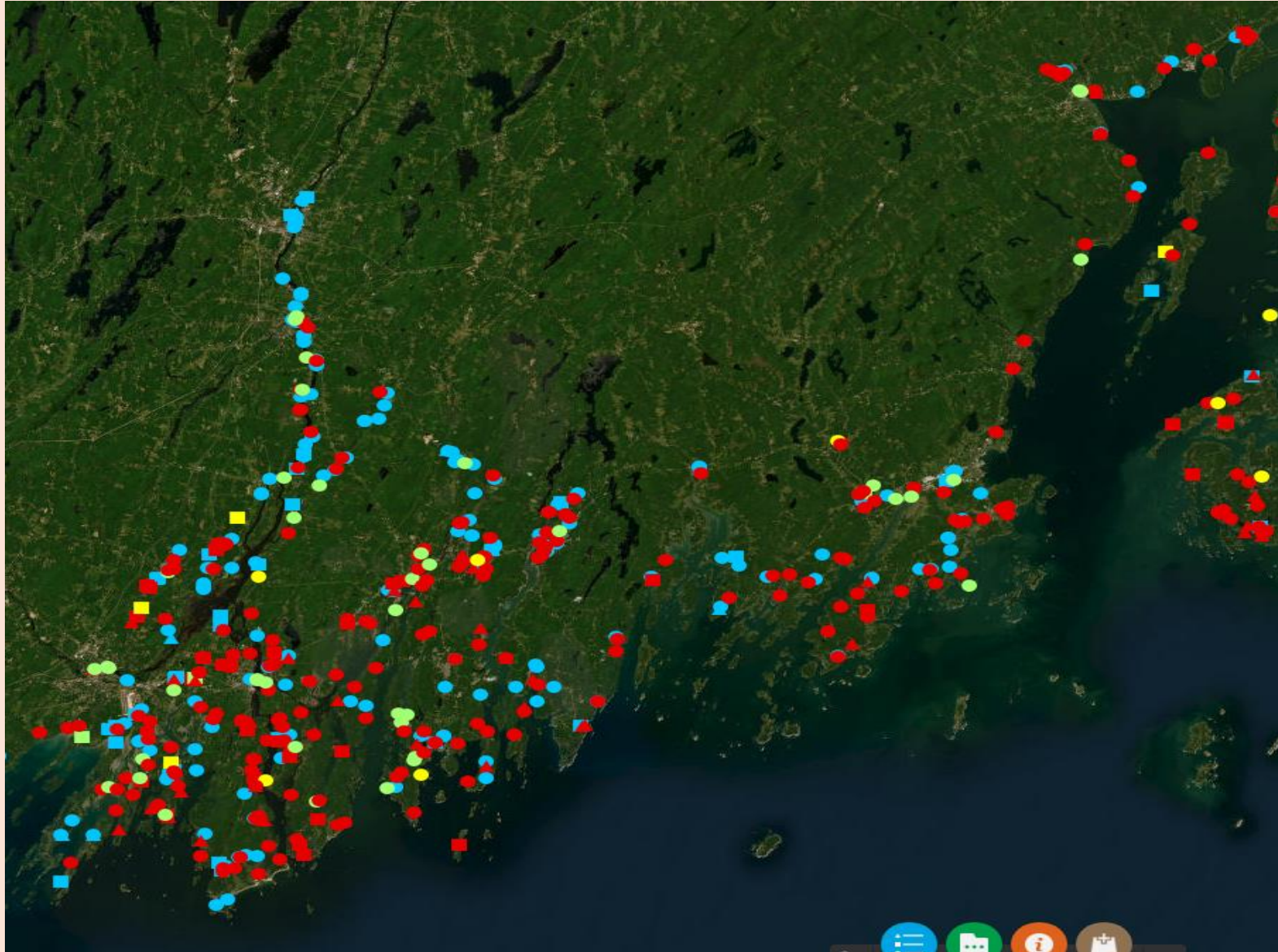
Why are Salt Marshes important?

.....and, they maintain coastal economies!!

Working Waterfront → Supports Local Coastal Economy →
Uses Marine Natural Resources → Open Water\Salt
Marsh\Mud Flat habitat

*NOAA: 70% of all commercially marketed marine species
spend some portion of their life cycles in intertidal habitats.

Maine Tidal Restriction Atlas: Crossing restrictions in the MidCoast



900 tidal road crossings statewide – 800 are undersized. This number will grow over time.



How can YOU undertake a Coastwise project?

- **Connect with a Technical Advisor**
- **Ask for Advice!!!** – Any time. It's a TEAM effort.
- **Start Early** – A project will take 2-4 years to completion.
- **Encourage Local Participation** – Make it a town project.
 - Get to know your town's crossings (desktop, field survey)
 - Establish clear objectives
 - Include Sea Level Rise
 - Include low-lying features of concern
- **Decide What Level of Risk is Appropriate** - How much inundation will be acceptable?

How can YOU undertake a Coastwise project?

- **Collect Preliminary Data**
- **Engage a Qualified Engineer** – For modeling, design services, and contracting documents.
- **Permitting and Coordination** – Discuss permitting needs, timelines, and expectations early on with state and federal regulators.
- **Serve as an Information Source** – Answer questions and concerns of residents.
- **Stay Involved in the Process** – Meet regularly with the Technical advisor and engineer.

How can YOU undertake a Coastwise project?

Contact a Technical Advisor to get started:

Statewide:

Robert Van Riper

Coastal Habitat Restoration
Specialist

Maine Coastal Program

Maine Department of Marine
Resources

Robert.vanriper@maine.gov

207-592-5689

Bill Bennett

Fish and Wildlife Biologist

Gulf of Maine Coastal Program

US Fish and Wildlife Service

William_Bennett@fws.gov

207-781-8364 X15

Casco Bay:

Matt Craig

Habitat Program Manager

Casco Bay Estuary Project

Matthew.craig@maine.edu

207-228-8359



Questions ??

Some Desktop Resources

- Tidal Restriction Atlas - DMR ME Coastal Program Website
- Coastal Risk Explorer – TNC Website
- Maine Stream Habitat Viewer – MDIFW Website
- Maine DOT Public Map Viewer – MDOT Website
- Beginning With Habitat – MDIFW Website
- Google Earth
- Maine Geolibrary - MEGIS Website
- USGS Historical Topo Explorer – USGS Website
- Historic Aerial Photo Library – ME Geological Survey – DACF Website
- NOAA – All at NOAA Websites
 - Section 7 Mapper (Threatened and /Endangered Species)
 - Essential Fish Habitat Mapper
 - Digital Earth

OUR SHORE

Nature-based Shoreline Stabilization Practices

Nathan Robbins
Climate Change Program



MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION

Protecting Maine's Air, Land, and Water

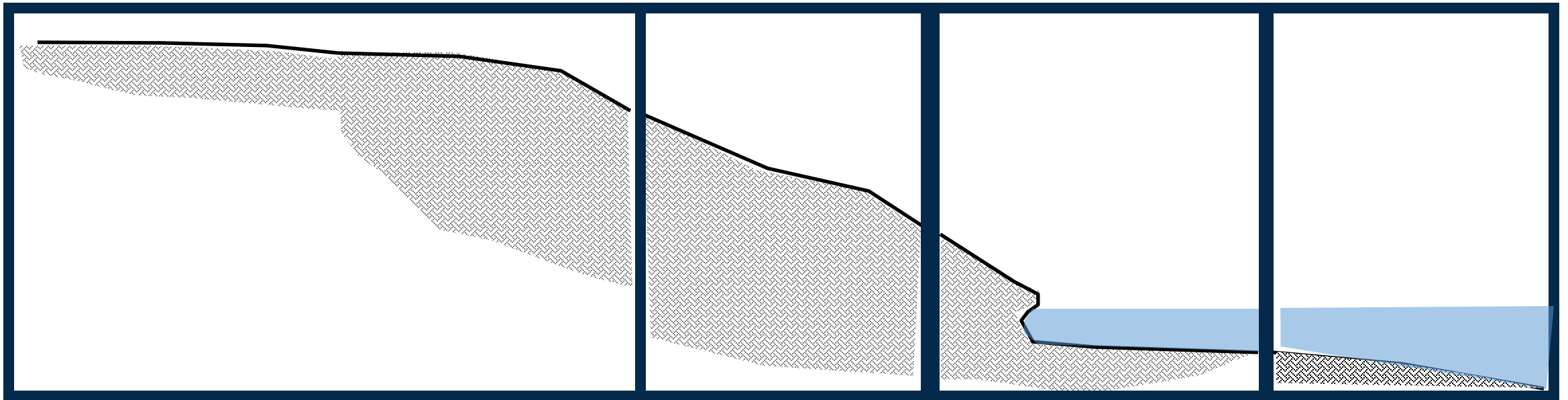
A Combination of Factors

Land Use & Overland Water

Height/Slope of
Bank & Soil
Protection

Toe Stability &
Groundwater

Wave energy



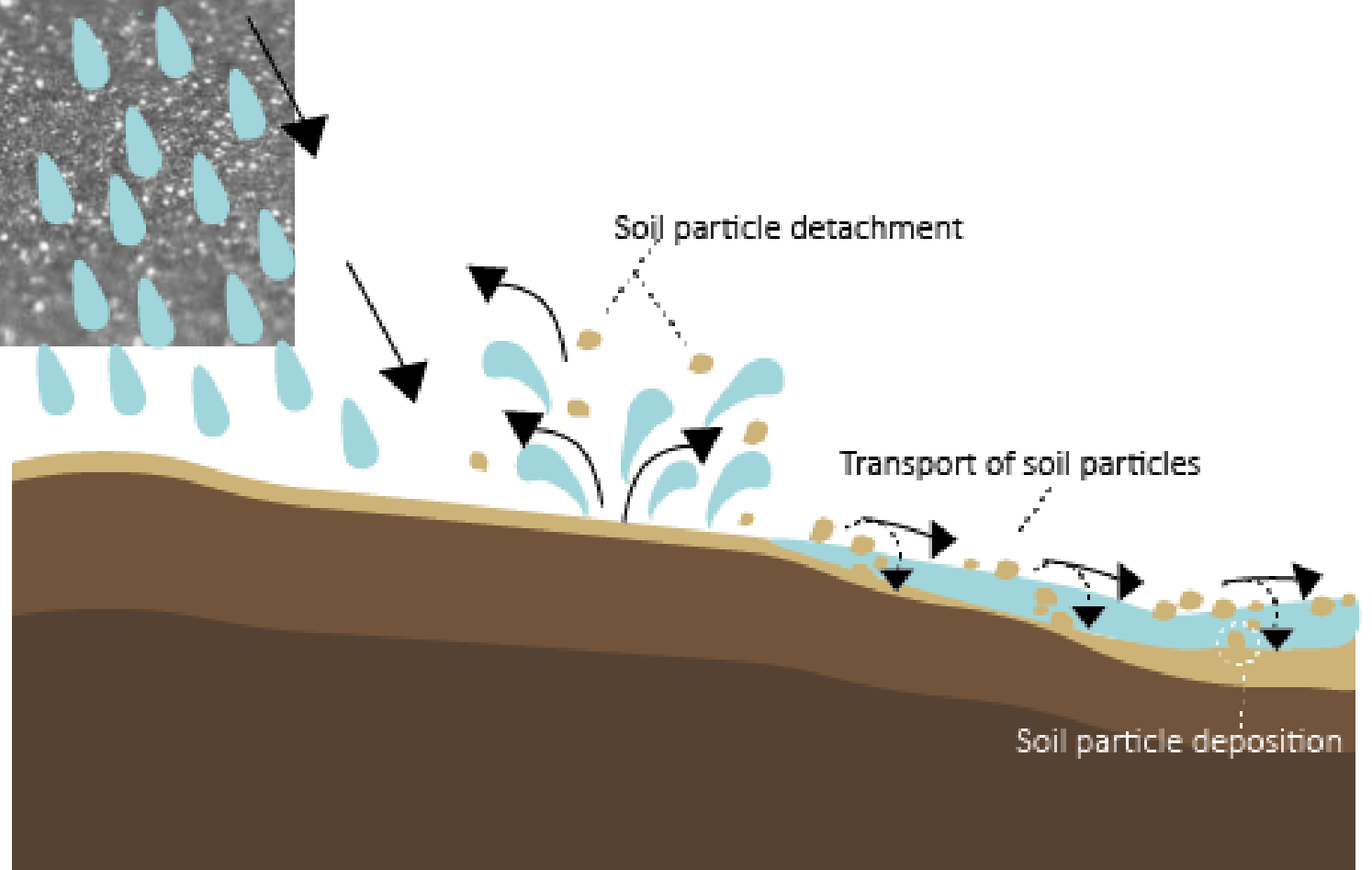
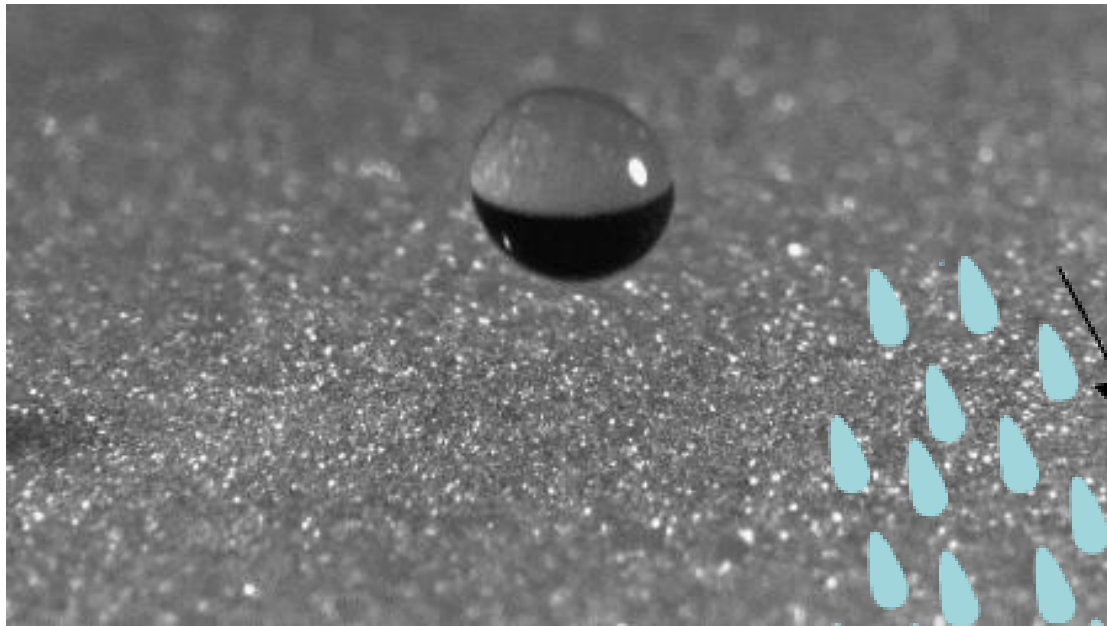
What's on the land?

How tall and
steep is the
slope?

What's
happening at
the bottom?

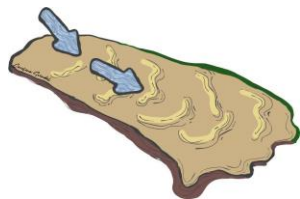
How big are the
waves and
currents?



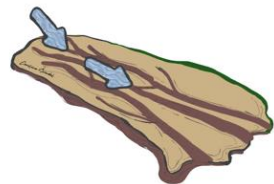




Splash
(Raindrop)



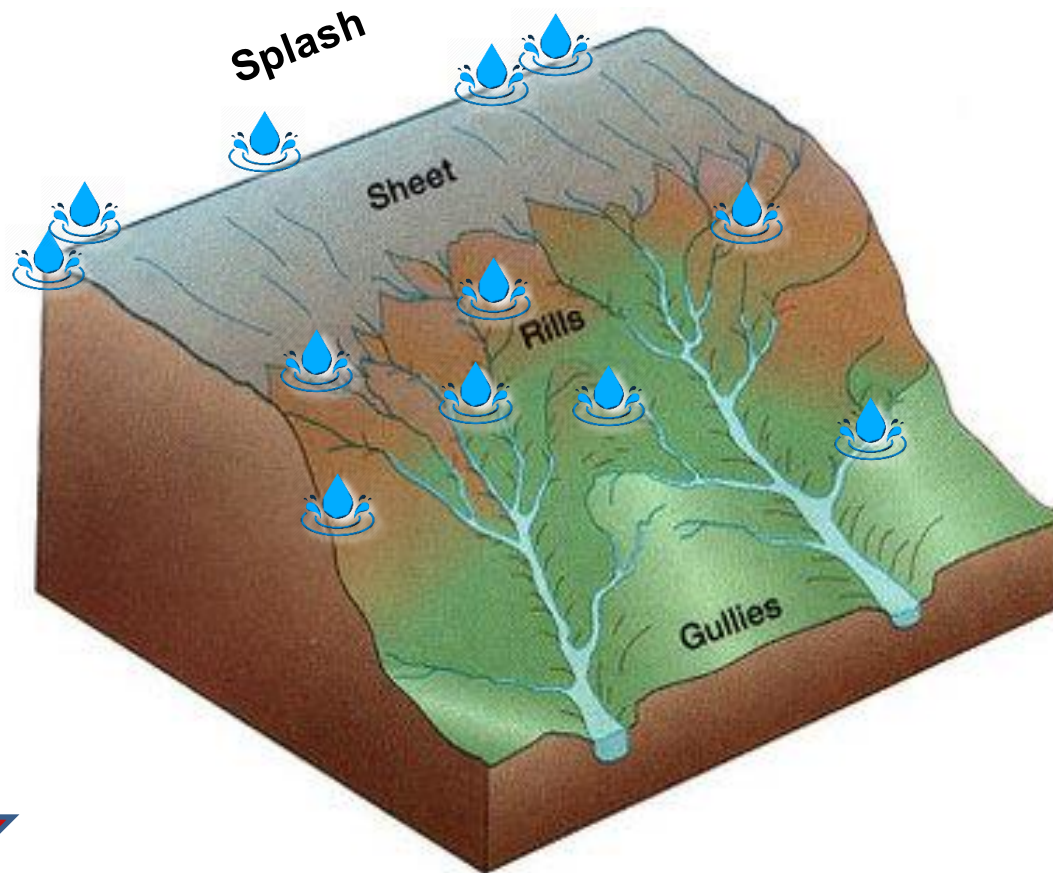
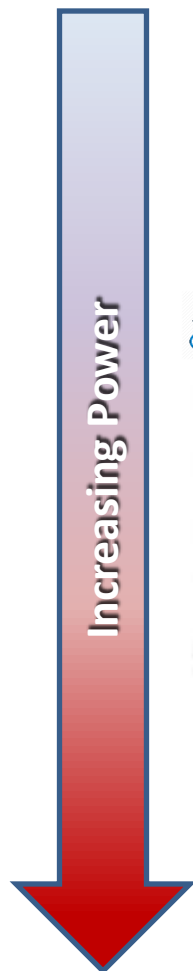
Sheet



Rill
(Shallow concentrated)



Gully
(Concentrated)

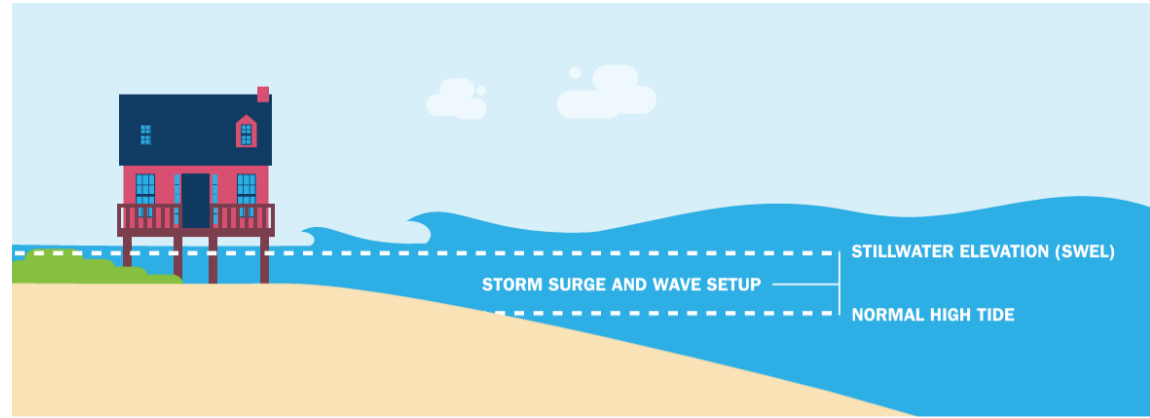
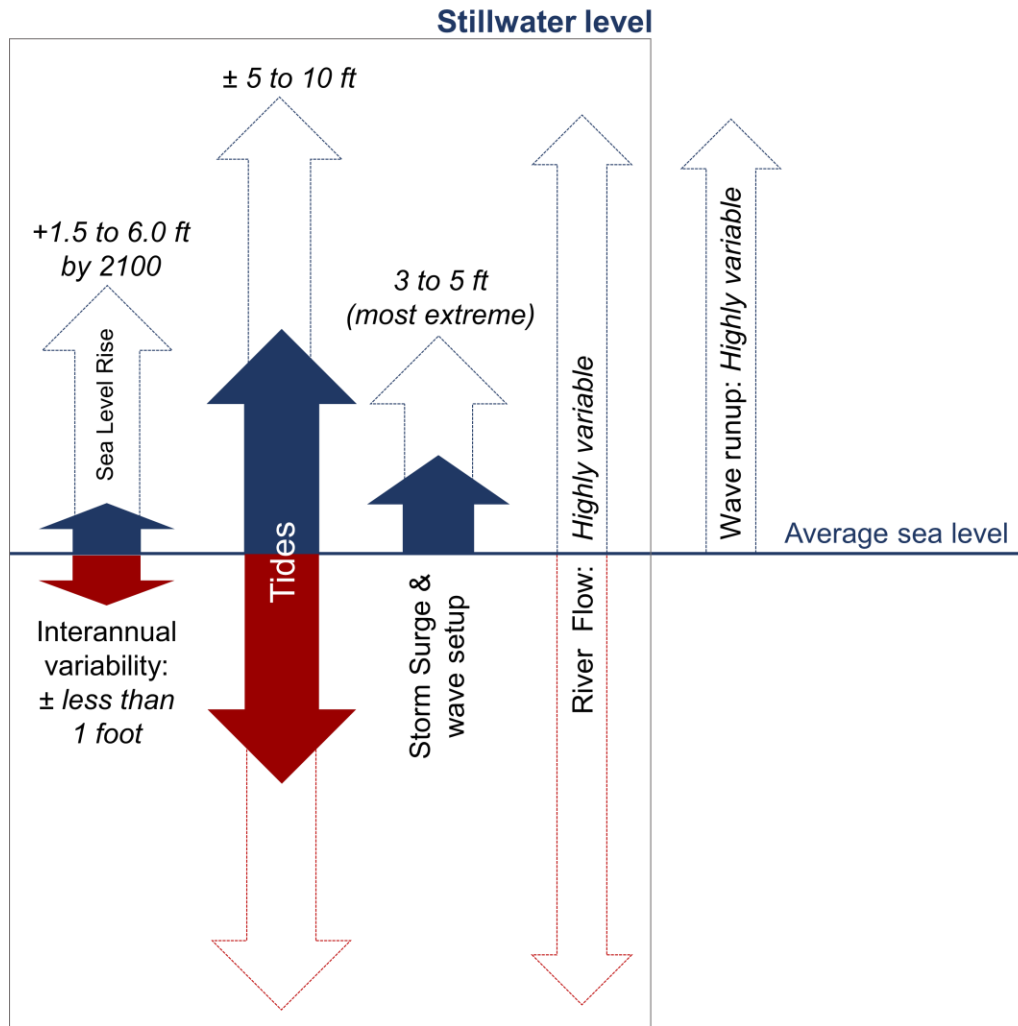


High Water



Waves





Illustrations from *FEMA Coastal Hazards and Flooding: A Visual Guide* showing stillwater elevation (upper panel) and wave runup and overtopping (lower panel).



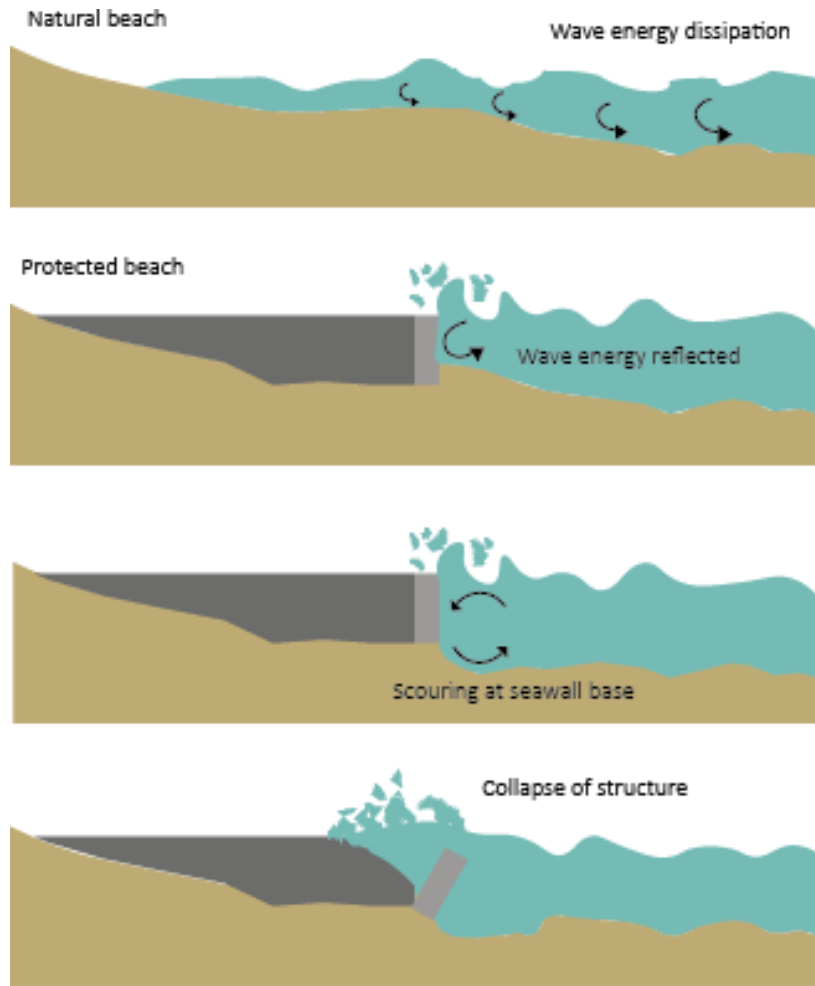
Sea Level Rise

Current Storm

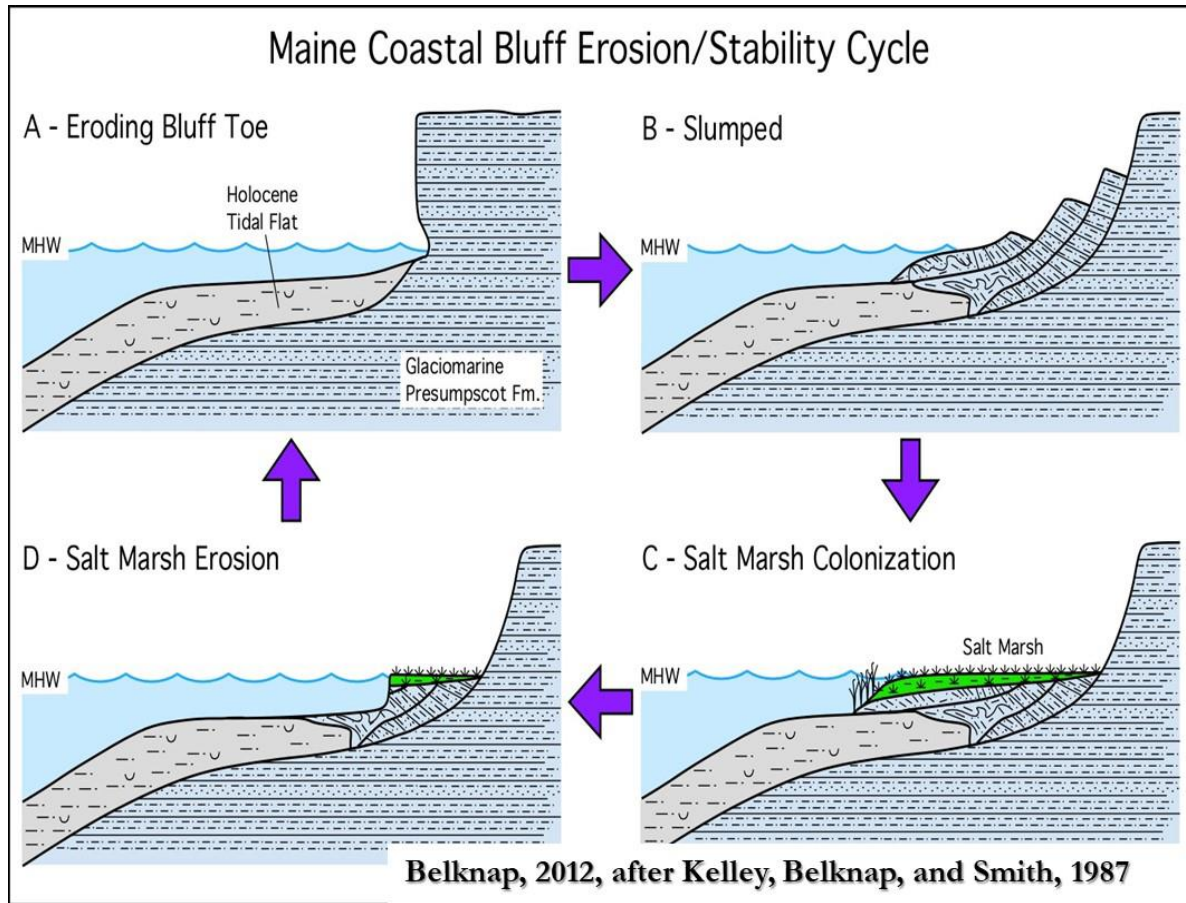


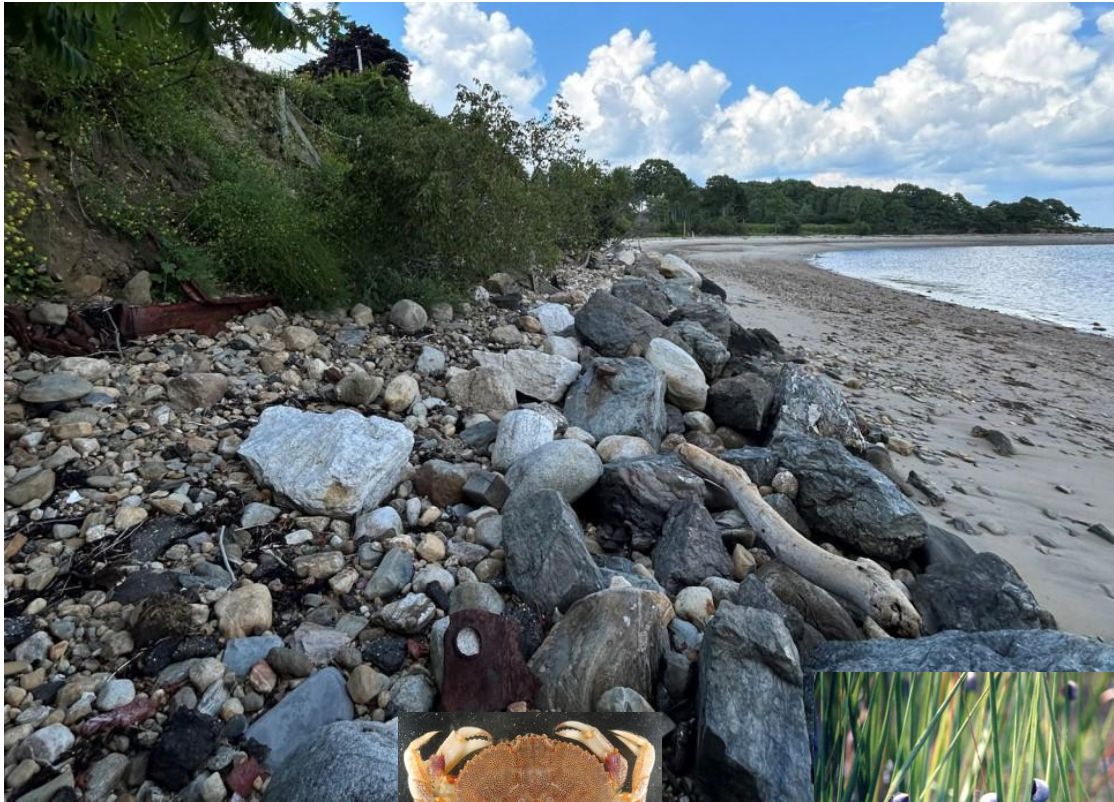






What if the soils are sandy?







“OUR SHORE” CONCEPT



Assessment & Selection of Stabilization Tools that:

1. Use the least amount of intervention and disturbance necessary
2. Allow shorelines to function as natural systems as quickly as possible

This is key to protecting the shoreline stability, water quality, and habitat for fish and wildlife in the long term



O

Design goals and objectives

Observe and blend project with unaltered shorelines near the site,

Use native, natural, living, and biodegradable materials, and

Reach conditions that function as a naturalized shoreline over time.

U

R

S

Assessment of instability

Source and severity of erosion,

Height and slope risk,

Overland water and land use, and

Re-vegetation or reconnection shoreline buffer opportunities.

H

O

R

Based on findings

Erosion control practices can be selected based on site specific needs.

E

Quick Assessment & Selection Checklist
Nature-based Solutions to Shoreline Erosion

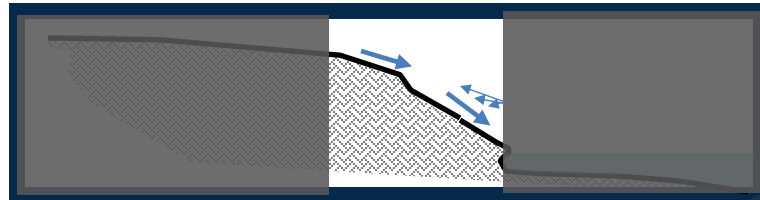
This tool is intended for use by homeowners, contractors, municipal officials, and others involved in the assessment, selection, or construction of shoreline stabilization projects. Use this resource for selecting appropriate tools and practices to stabilize shorelines using the least amount of intervention to become more resilient to erosion, and function as natural systems, protecting the shoreline, water quality, and habitat for fish and wildlife in the long term.

Design Goals & Objectives	O	Observe and blend the project with unaltered shorelines near the site
	U	Use native, natural, living, and biodegradable materials
	R	Reach conditions that function as a naturalized shoreline over time
Assess Sources of Instability & Erosion	S	Source & Severity of Erosion Assess the contributions of instability by source such as Surface water Flows, Groundwater, wave action/ ice erosion, and ice.
	H	Height & Slope Risk Assess contributions of height, slope, and soil conditions to instability risk
	O	Overland Water and Land Use Assess how use of the site may affect stability
	R	Re-vegetate/Re-connect Shoreline Buffer Assess the existing shoreline vegetation and the contribution to stability, water quality, & shoreline habitat connectivity.
Implement	E	Erosion Control Selection Based on Site Select stabilization practices after assessing the causes of instability to create a targeted stabilization plan based on the needs of the specific site conditions, while meeting the "D-U-R" design objectives.

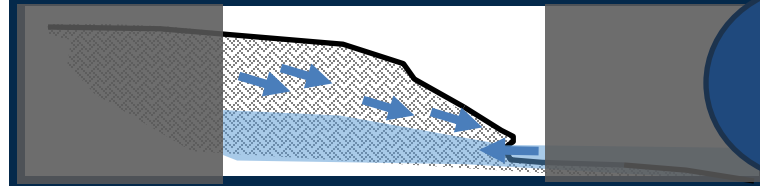
MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION
www.maine.gov/dep



Overland Erosion & Wave Spray

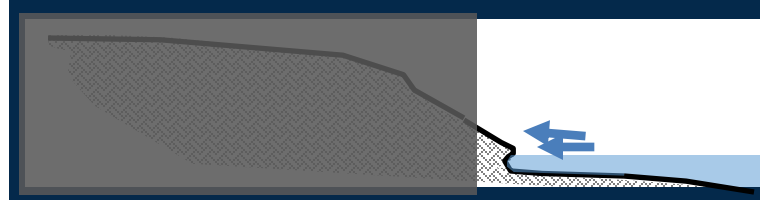


Groundwater & Saturation



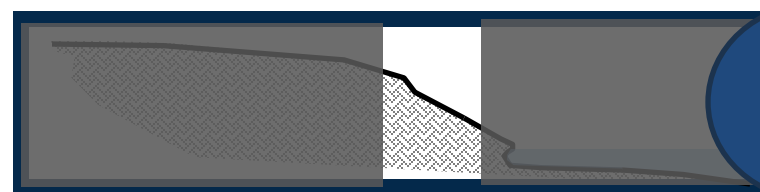
Source of Erosion

Toe Erosion

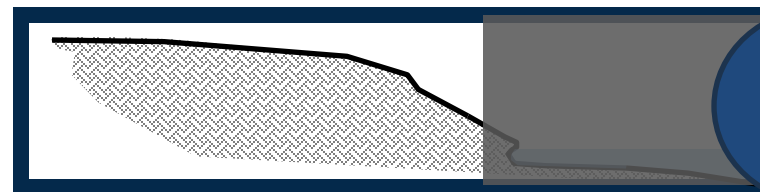


Slope Alterations

Slope Protection



Height & Slope



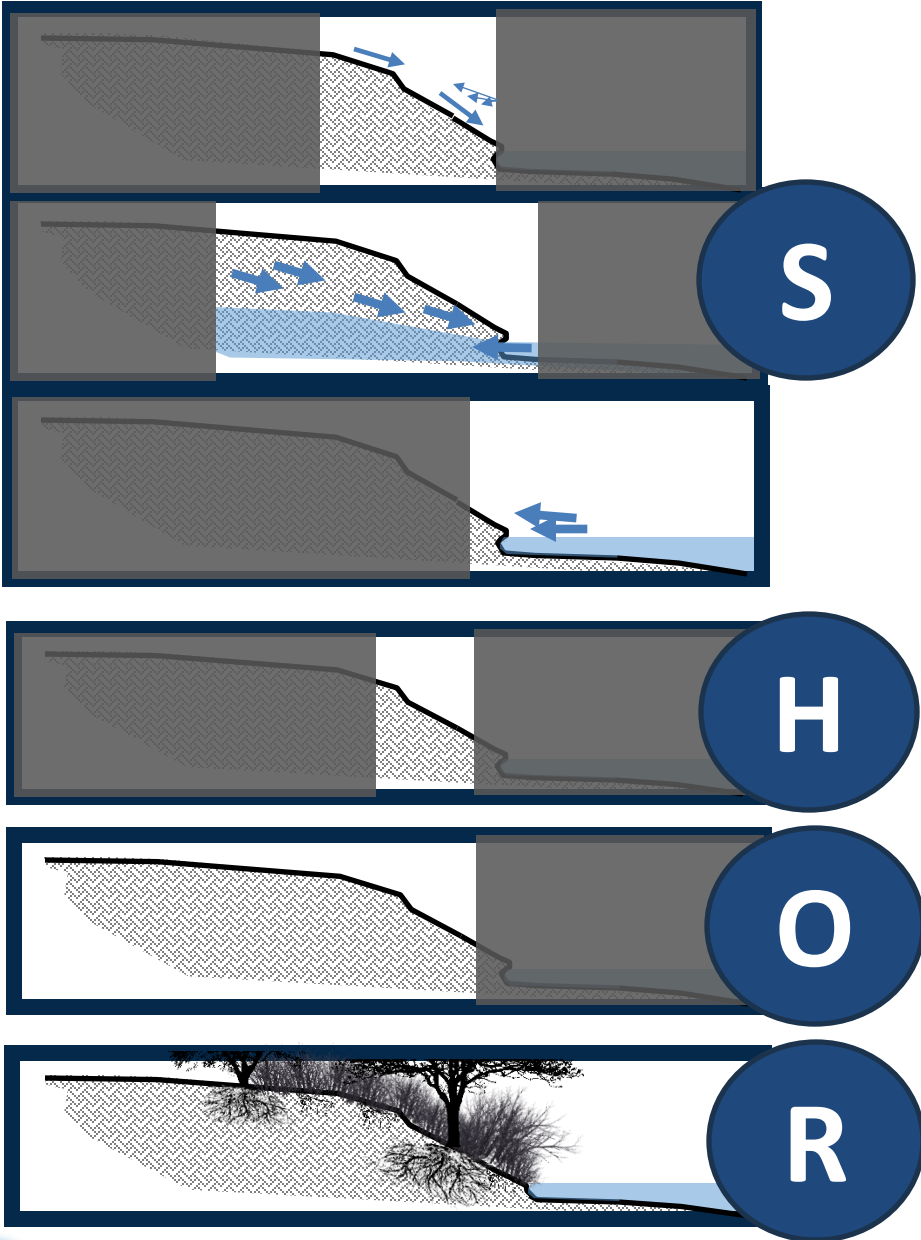
Overland Water from Land Use



Revegetate & Re-connect (Habitat)

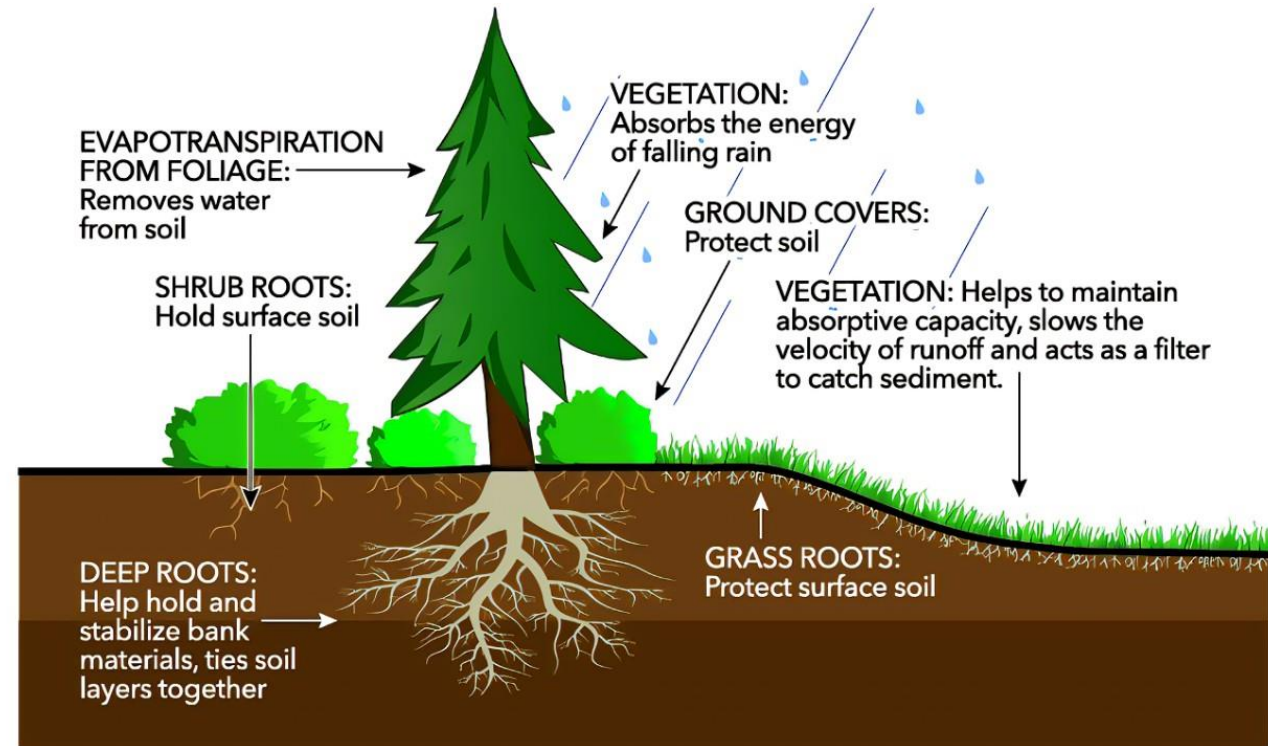
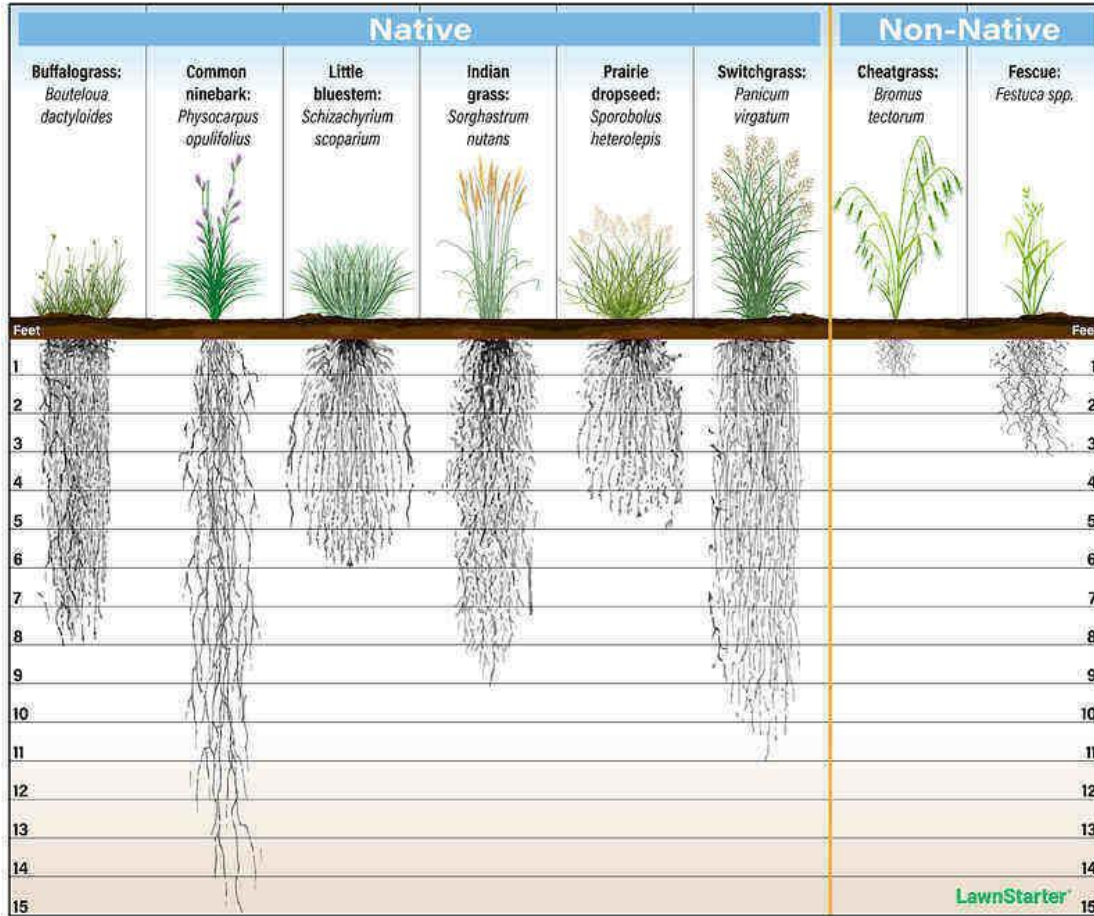


Slow the Flow. Spread it Out.



Stabilize Soils

ROOT SYSTEMS OF NATIVE VS. NON-NATIVE PLANTS



EFFECTS OF VEGETATION IN MINIMIZING EROSION





Minimize...

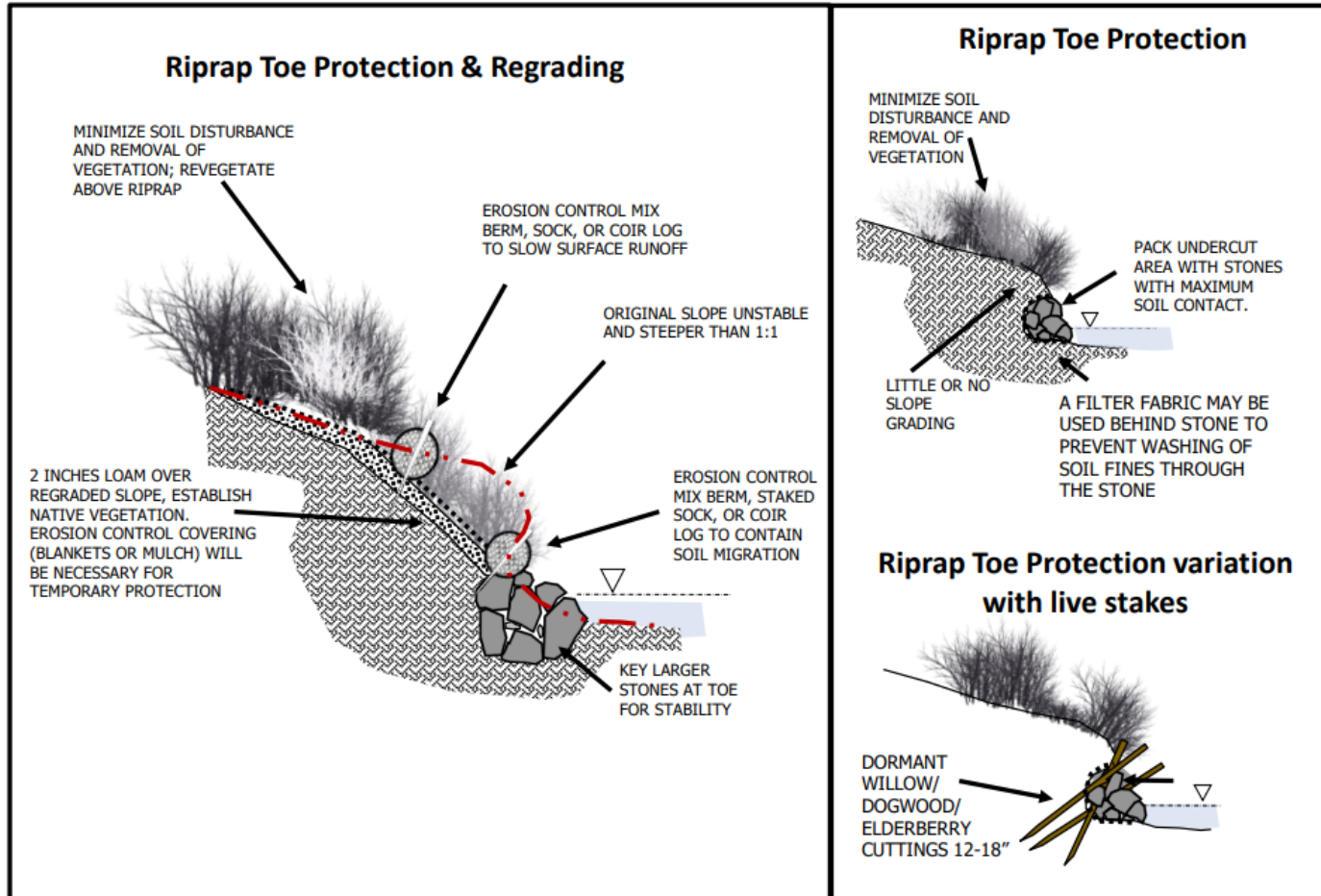
Destruction of habitat (species connectivity)

Energy deflection (nearshore and adjacent erosion)

Jumpstart protection with plants



Combining Practices

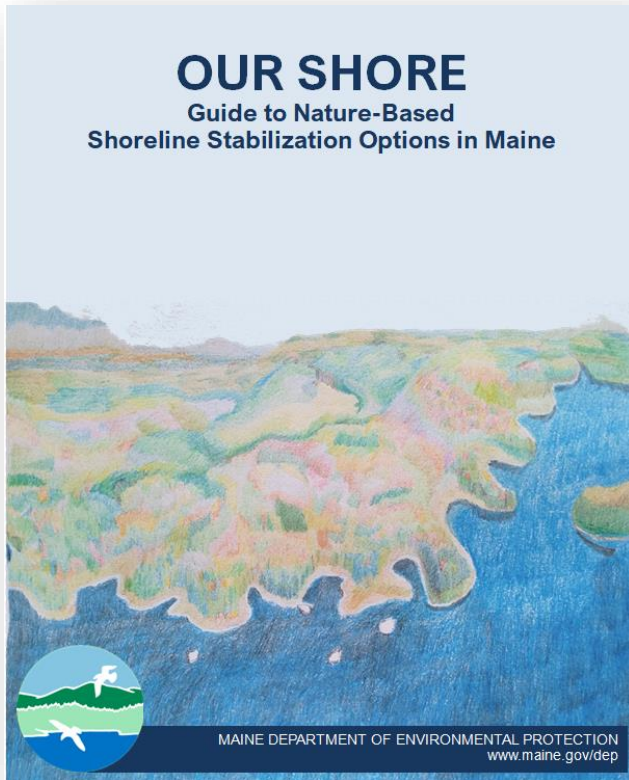












OUR SHORE: Guide to Shoreline Stabilization Options

Comprehensive guide to the OUR SHORE approach

- **Basic Guidance on Shoreline Function**
Shoreline erosion process, role of vegetation, OUR SHORE concept
 - **Assessment of Erosion Sources**
Sources of instability and severity of risk
& Assessment Checklist of Erosion and Erosion Control Practices
 - **Tools and Practices**
Descriptions and pictures of common design practices covered in the guide
- **Common Materials in Nature-based Shoreline Stabilization**
Short list of common materials
 - **Planting Guide**
Summarizes go-to planting guides for Maine landscapes (includes short list of inland and coastal shoreline plants)
 - **Outcomes & Case Studies**
Example design solutions for different landscapes and case studies (Lakes, Rivers, Streams, Beaches and Dunes, Bluffs)

Assess sources of erosion

Identify appropriate design practices

Navigate permit processes



IN DEVELOPMENT

Nature-Based Solutions to Shoreline Erosion

Preliminary **DEP Issue Profile**
November 2024
For more information, contact John MacLaine
John.MacLaine@maine.gov

Coastal and inland waterfront erosion in Maine is a growing concern due to storms, flooding, and rising sea levels. Nature-based design solutions may offer an effective, long-term plan for safeguarding both private and public property. These designs provide strength, improve the beauty of waterfront properties, and bring a range of benefits to the community and to the health of the environment. Unfortunately, we are learning that rip-rap stone revetments without plants can make erosion worse for neighboring waterfront areas, are failing during storms, and may not be a resilient solution to erosion.

Nature-Based Solutions to Shoreline Erosion, also known as "Living Shorelines," are design techniques that use natural materials to combat shoreline erosion and flooding, while at the same time offering many advantages to the local ecosystems. These designs have a proven track record in Maine, especially along rivers, streams, and lakes. The application of Nature-Based Solutions for erosion management is expanding to include estuaries and ocean coasts in Maine where the challenges presented by wave energy, tidal fluctuations, and winter ice can be severe.

Find Nature Based Solutions Quickly!

"O.U.R. S.H.O.R.E." provides guidance and training for installing Nature-Based solutions to protect against inland and coastal waterfront erosion. This program offers detailed how-to information across Nature-Based best practices and showcases different project examples from throughout the state. Through "O.U.R. S.H.O.R.E.," people can:

1. Assess sources of erosion.
2. Identify design recommendations.
3. Navigate regulatory process to streamline installation of Nature-Based erosion control measures.

This program serves homeowners, contractors, resource managers, and community leaders, providing them with the necessary support to successfully use Nature-Based Solutions.

The **Assessment Checklist for Erosion** offers a streamlined process checklist for site evaluation and selection of Nature-Based design practices.



Observe and blend project with unaltered shore near site.

Use native, natural, living, and biodegradable materials.

Reach conditions that function as a naturalized shore over time.

Nature-Based Solutions incorporate a blend of plants that root into the environment, helping sediment exchange and accumulation. As plant communities mature, these designs gain strength, offering greater resilience over time compared to traditional rip-rap revetments (See Photo 1). Living shorelines present a sustainable and cost-effective alternative for protecting shorelines against destruction from storms and waves.

Nationwide, Nature-Based Solutions are becoming embraced as the most effective plan to address waterfront and riverfront erosion.

MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION
www.maine.gov/dep

Quick Assessment & Selection Checklist Nature-based Solutions to Shoreline Erosion

This tool is intended for use by homeowners, contractors, municipal officials, and others involved in the assessment, selection, or construction of shoreline stabilization projects. Use this resource for selecting appropriate tools and practices to stabilize shorelines using the least amount of intervention to become more resilient to erosion, and function as natural systems, protecting the shoreline, water quality, and habitat for fish and wildlife in the long term.

Design Goals & Objectives

- O** Observe and blend the project with unaltered shorelines near the site
- U** Use native, natural, living, and biodegradable materials
- R** Reach conditions that function as a naturalized shoreline over time

Assess Sources of Instability & Erosion

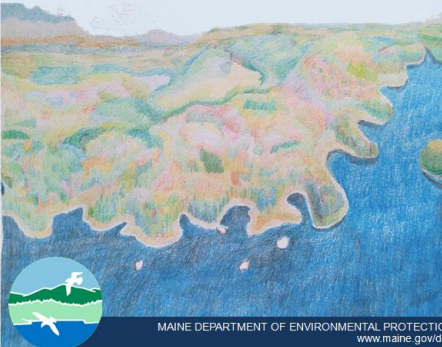
- S** Source & Severity of Erosion
- H** Height & Slope Risk
- O** Overland Water and Land Use
- R** Re-vegetate/Re-connect Shoreline Buffer

Implement

- E** Erosion Control Selection Based on Site


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www.maine.gov/dep

OUR SHORE Guide to Nature-Based Shoreline Stabilization Options in Maine



MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION
www.maine.gov/dep

Step by Step Permit for Erosion Control



* Take photos of the Landscape before damage has occurred
* Take photos of the Landscape after damage

- STEP 1** DETERMINE APPLICABLE PERMIT BY RULE SECTIONS
Permit-by-Rule regulations (Chapter 205) apply to certain activities covered under the Natural Resources Protection Act (NRPA). Find the section for your type of proposed activity in the Chapter 205 standards above.
- STEP 2** REVIEW CHAPTER 305 SECTION STANDARDS
For each section selected, read Applicability that describes in further detail which activities are included and where they are allowed. Read and comply with all the standards contained in the section.
- STEP 3** FILL OUT PBR NOTIFICATION FORM, & COLLECT SUBMISSION DOCUMENTS
Permitted by Rule Notification Form
Dept. of Fisheries Resources Tinting Form
Inland Fisheries & Wildlife Tinting Form
Maine Geological Survey Storm Water Restoration/Beach nourishment review form
Other NRPA forms
- STEP 4** PAY PBR FEE ONLINE
DEP fee schedule
* The required fee is contained in the Department's fee schedule.
* Payment of the application fee is accepted by credit card through the Department's payment portal.
* Pay the fee prior to filing and include confirmation of credit card payment with email submission of your PBR.
- STEP 5** SUBMIT PBR, ATTACHMENTS AND PROOF OF PAYMENT VIA EMAIL
The Department requires the submission of Natural Resource Protection Act (NRPA) and Stormwater Permit-by-Rule (PBR) notifications by email to: DEP_PBRNotification@maine.gov
- STEP 6** THE PBR IS EFFECTIVE AFTER 14 DAYS UNLESS OTHERWISE NOTIFIED BY THE DEPARTMENT
The PBR becomes effective 14 days from the date the Department receives the full submission (email notification and fee), unless the Department approves or denies the PBR prior to that date.

MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION
www.maine.gov/dep

Planting Guide Summary

Preliminary OUR SHORE Guide to Nature-Based Shoreline Stabilization Options in Maine

Selecting appropriate plants for a living shoreline is essential to long-term performance of the design and to restore habitat to natural conditions. This summary provides available planting guides for Maine landscapes, go-to sources recommended by experts who are designing and installing stabilization projects using nature-based practices, and a short list of coastal living shoreline plants.

Natural Landscapes of Maine:
A Guide to Natural Communities and Ecosystems
<https://www.maine.gov/dep/fmsap/publications/>

An essential part of the OUR SHORE approach is to maintain, restore, and enhance shoreline habitat elements. The Maine Natural Areas Program maintains descriptions of natural communities and ecosystems that illustrate what property owners and contractors should aim to achieve with their designs. Publications include detailed descriptions, maps, and photographs that serve as a valuable tool for understanding the rich biodiversity and environmental heritage of Maine's natural areas.

Maine Coastal Planting Guide
<https://www.cumberlandwd.com/documents/1/coastal-plant/>

This guide offers insights on selecting and cultivating plants that thrive in coastal conditions, such as salt spray, sandy soil, and strong winds, making it a valuable resource for coastal property owners, landscapers, and conservationists looking to establish resilient and visually appealing landscapes along the Maine coast. With tips on plant selection, maintenance, and design considerations specific to coastal settings, this planting guide serves as a practical tool for enhancing the ecological and aesthetic value of coastal areas in Maine.

Coastal Living Shoreline Plants

Low Marsh

- Juncus gerardi- saltmarsh rush
- Spartina alterniflora- smooth cordgrass

High Marsh

- Spartina patens- saltmeadow cordgrass
- Distichlis spicata- seashore saltgrass

Inland & Coastal Living Shoreline

Herbaceous Perennials

- Solidago sempervirens- seaside goldenrod
- Symphoricarum novae-angliae- new england aster
- Symphoricarum novi-belgii- new york aster

Trees & Shrubs

- Acer rubra- red maple
- Amelanchier arborea- serviceberry
- Cornus sericea- red os dogwood
- Diervilla lonicera- bush honeysuckle
- Myrica pensylvanica- bayberry (Coastal)
- Pinus strobus- white pine
- Rosa carolina- pasture rose
- Rosa virginiana- virginia rose
- Rhus glabra- smooth sumac
- Salix nigra- black willow
- Spiraea alba- meadowswaest
- Spiraea tomentosa- steepplebush

MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION
www.maine.gov/dep

PROGRAM
ISSUE
PROFILE

ON SITE
CHECKLIST

OUR SHORE
GUIDE

PERMITTING
SUPPORT

PLANT
SELECTION

Chapter 305 §16-A Beach Nourishment and Dune Restoration or Construction in Coastal Sand Dunes (Emergency)

- Allowed for biodegradable materials in dune restoration projects (expired in early May 2024)

Chapter 305 Permit-By-Rule & Chapter 310 Wetlands and Waterbodies

- DEP proposed rule changes to the BEP (November 2024)
- Proposal includes §16-A changes
- Creates a definition for “shoreline stabilization”
- Adds section to establish standards for purpose of shoreline stabilization projects
- Encourages permitting for use of vegetation and biodegradable materials
- Places some limits on the use of hardened stabilization structures



An aerial photograph of a coastal city at dusk. The city is densely packed with buildings and roads, situated along a coastline. In the background, a large body of water, likely a bay or harbor, is visible, with a prominent circular island or peninsula. The sky is a mix of soft orange and blue, indicating the time is either early morning or late evening. The overall scene is serene and captures the natural beauty of the coastal environment.

THANK YOU

These initiatives would not be possible without the contributions of *many* agency, contractor, municipal, and other resilience practitioners

RESOURCES

Nonpoint Source Training Center

<https://www.maine.gov/dep/land/training/index.html>

Department Rulemaking Proposals

<https://www.maine.gov/dep/rules/index.html>

Maine Conservation Corps

https://www.maine.gov/DACF/parks/get_involved/conservation_corps/index.shtml

Maine Climate Hub

maine.gov/dep/sustainability/climate/index.html

Maine Climate Science Information Exchange

<https://umaine.edu/mcsie/>





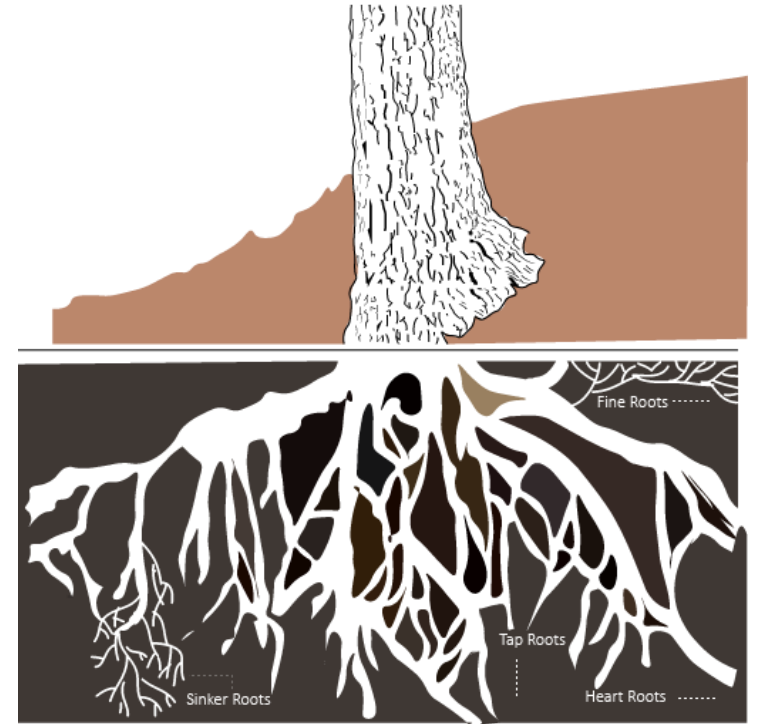
Contact:

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Nathan Robbins | Nathan.P.Robbins@maine.gov

Parker Gasset | Parker.Gasset@maine.edu

www.maine.gov/dep



Demystifying Nature-Based Strategies

Case Studies from Maine's coastal environments

Natural Hazards and Land Use Planning 101 Webinar Series



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(207) 287-7173 Office
(207) 441-1965 Cell



What's a "Living Shoreline"?

Living shoreline is a broad term that encompasses a range of shoreline stabilization techniques along estuarine coasts, bays, sheltered coastlines, and tributaries. A living shoreline:

- has a footprint that is made up **mostly of native material**.
- **incorporates vegetation** or other living, natural "soft" elements **alone or in combination with** some type of harder shoreline structure (e.g. oyster reefs or rock sills) for added stability.
- **maintains continuity of the natural land–water interface** and reduce **erosion** while providing **habitat value** and enhancing **coastal resilience**.

About 50% of our coastline is comprised of rocky cliffs where living shorelines don't make too much sense



Yet living shorelines can be implemented along much of Maine's coast



Sandy dune, Western Beach, Scarborough

Coastal Sand Dune Systems (sandy dunes, gravel and cobble dunes)

Coastal Bluffs and adjacent habitats (sand dunes, mud flats, sand flats, wetlands)

Coastal Wetlands (low marsh, high marsh)

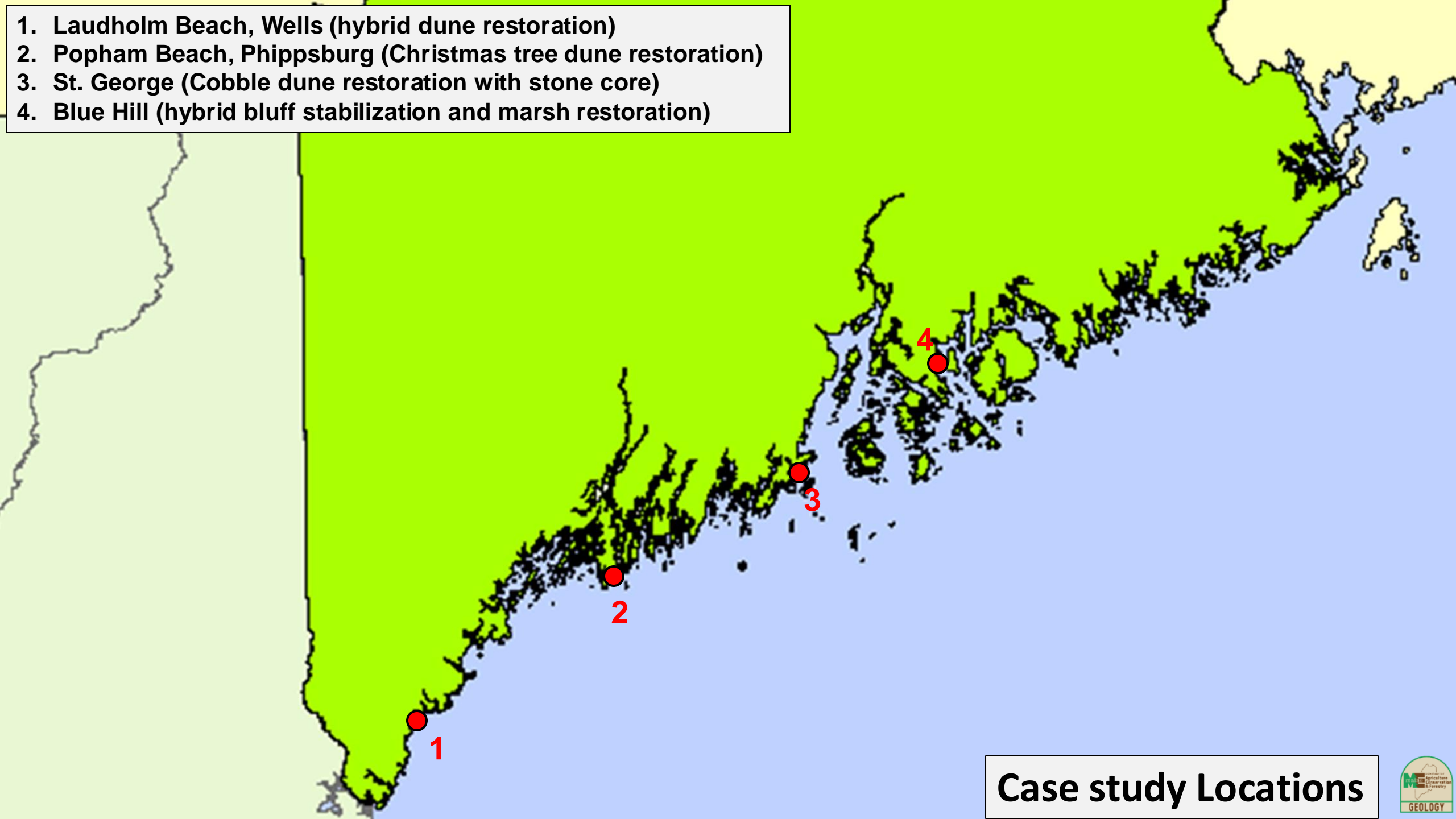


Coastal wetland, Wells

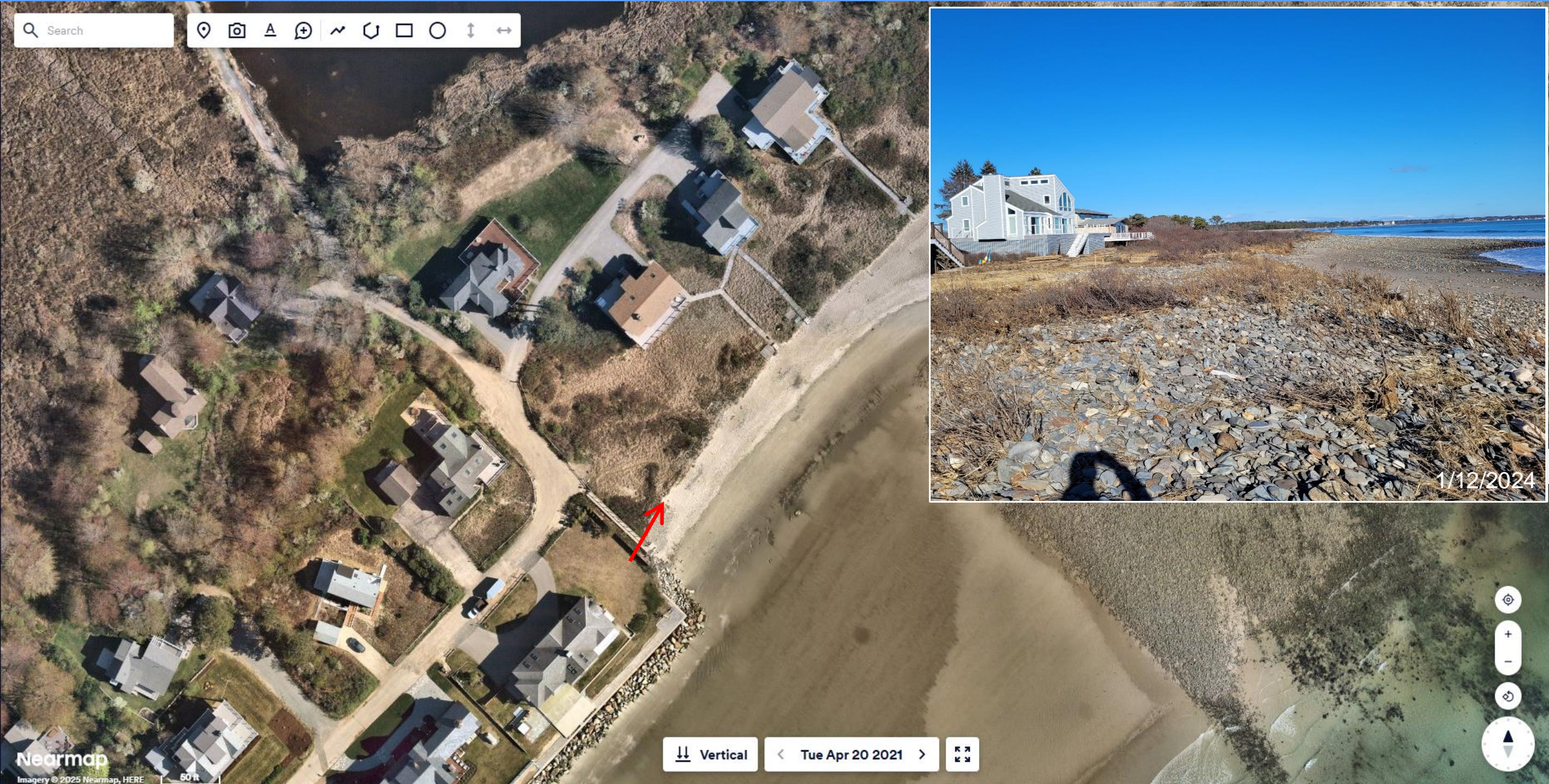


Bluff with adjacent mud flat, Brunswick

1. Laudholm Beach, Wells (hybrid dune restoration)
2. Popham Beach, Phippsburg (Christmas tree dune restoration)
3. St. George (Cobble dune restoration with stone core)
4. Blue Hill (hybrid bluff stabilization and marsh restoration)

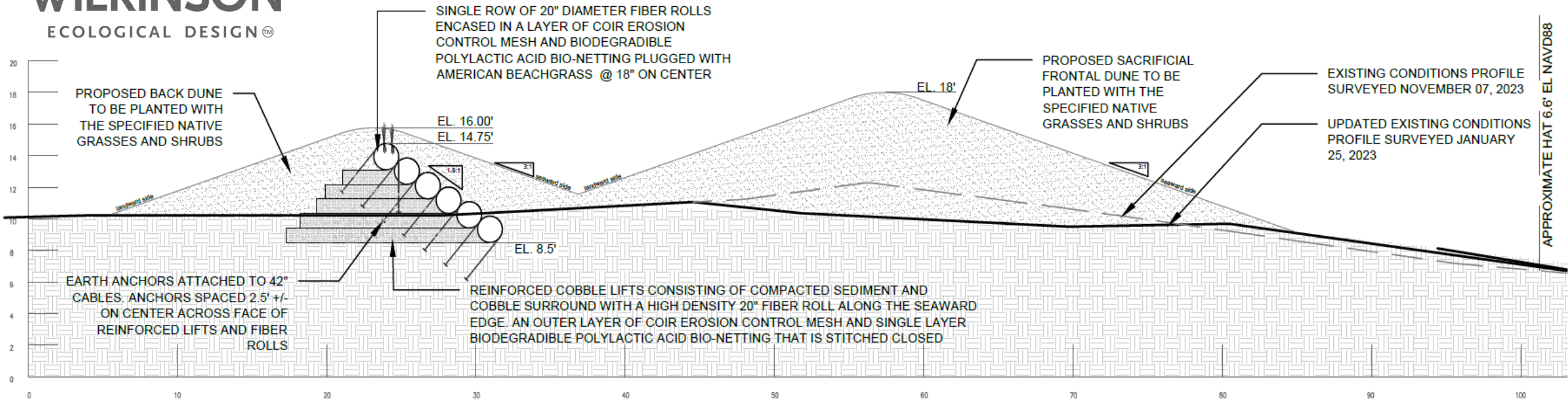


Case study Locations



Location: Laudholm Beach, at the end of Drakes Island Beach, Wells
The Problem: Long-term end-effect erosion of an adjacent natural dune system caused by seawalls





3 PROPOSED SECTION A-A'

Scale: 1/8" = 1'

Solution: Use harbor dredge sediment to construct a combination sacrificial and secondary dune ridge. “Sacrificial” dune exceeds the FEMA BFE by 3 ft and a secondary dune ridge by 1 ft. Secondary ridge uses a cobble lift/fiber roll core anchored with duckbill anchors (permitted since this is a cobble-dominated beach). Plantings include dune grass and bayberry shrubs. *This is the first dune restoration project in Maine to utilize an “enhanced” core.*

Permits: A Maine DEP Individual Permit was needed for the dune project. Because it was above the HAT, no USACE permit needed.

Cost: comparable to rip-rap shoreline.

Monitoring: drone imagery and topographic monitoring for 5 years.



V. Beaulieu, Wells Reserve, 12-2, 2024





V. Beaulieu, Wells Reserve, 12-16,2024.



Popham Beach

Popham Beach State Park

P2 West

Area completely denuded of protective dunes and vegetation after January 2024 storms

Location: Popham Beach State Park, Phippsburg

Problem: Episodic erosion from river migration and dune loss from storm-induced erosion

Solution: Demonstration project placing rows of holiday trees to trap sand and rebuild beach elevation and dunes.

Permits: a Maine DEP Solid Waste Permit and Maine DEP Permit-by-Rule were needed.

Cost: trees were donated; staff and equipment time

Monitoring: 2 years, annual photographs from same location



1985 2/2025 2023

Navigation controls: North arrow, pan, zoom, street view, and scale.



Image © 2025 Airbus

Photo documentation of project along Center Beach (3/2024-12/2024)

Google Earth interface elements: Imagery Date: 11/2/2023, 43°44'10.71" N, 69°47'50.52" W, elev 13 ft, eye alt 11, and logos for Google Earth and the Massachusetts Department of Agriculture, Conservation & Forestry.











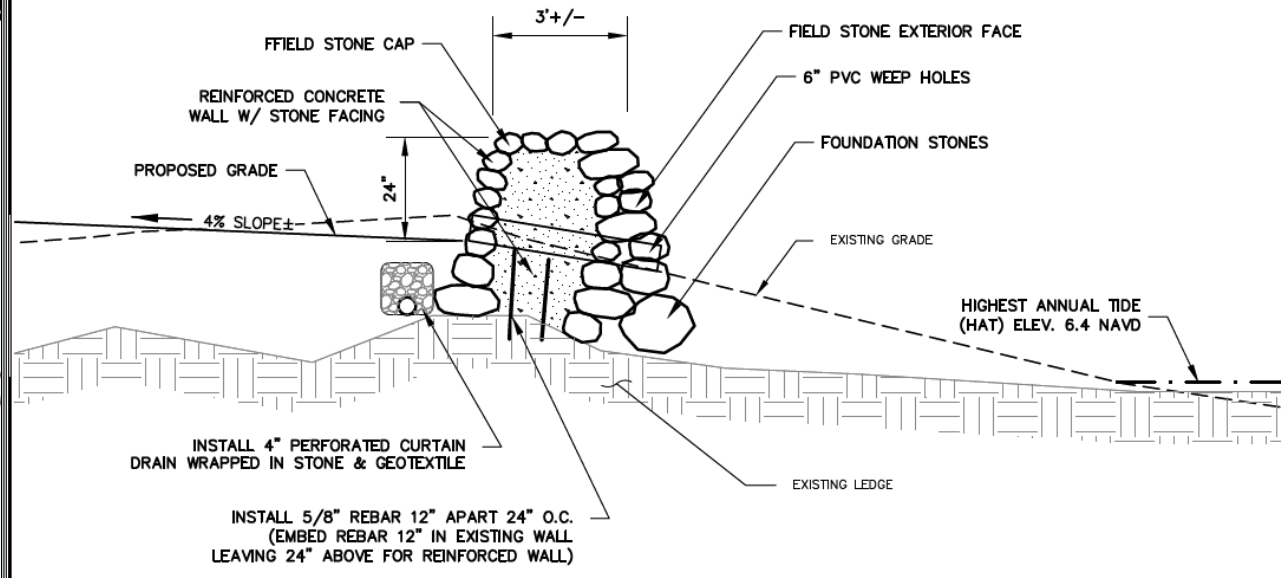


Location: St. George cobble dune system

Problem: Storm-induced washover of cobbles and potential erosion and flooding of property

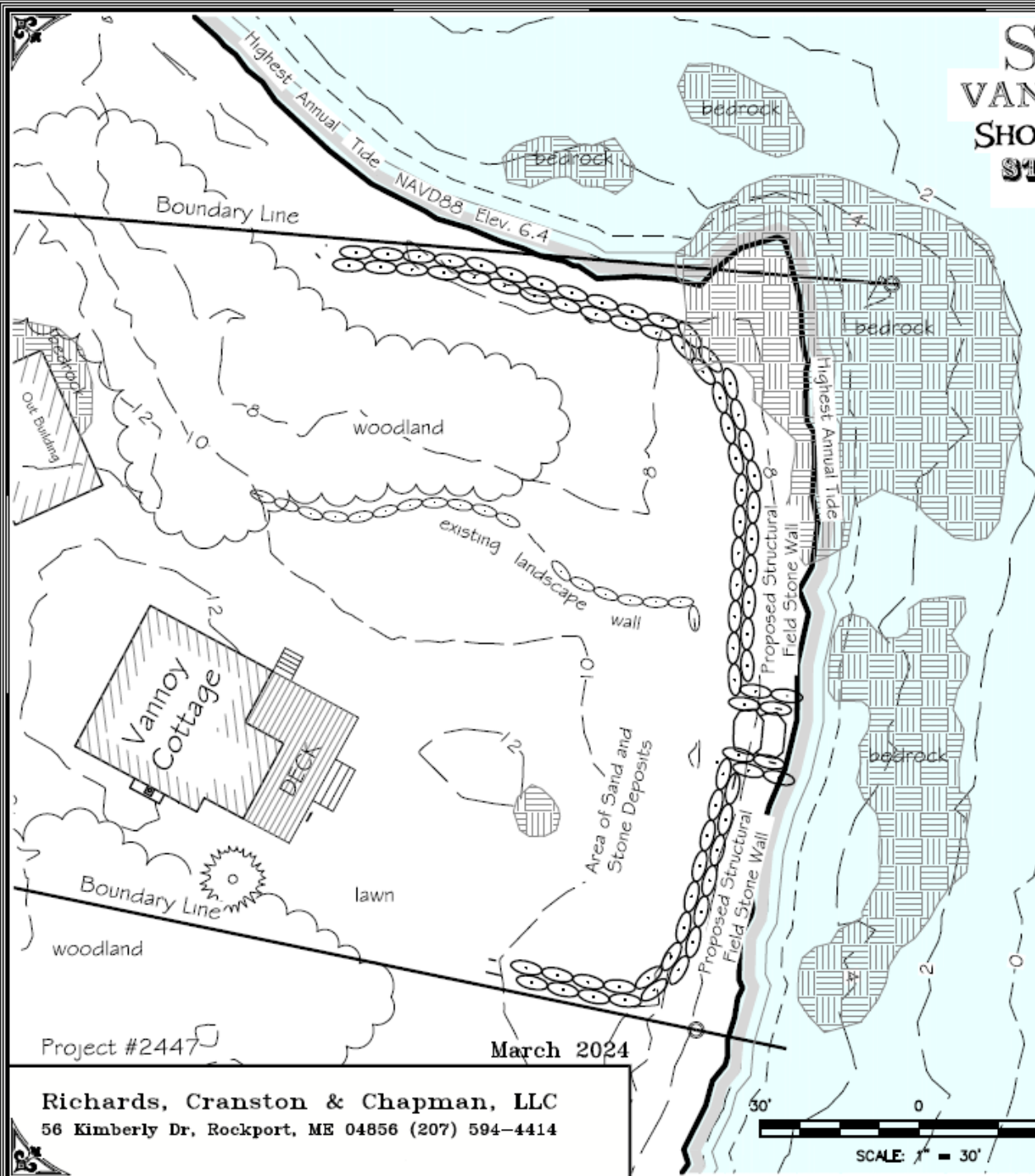
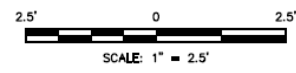


Typical Section
 VANNOY SHORELINE STABILIZATION
 MOSQUITO HARBOR
 ST. GEORGE, MAINE



Project #2447 April 2024

Richards, Cranston & Chapman, LLC
 56 Kimberly Dr, Rockport, ME 04856 (207) 594-4414



Project #2447

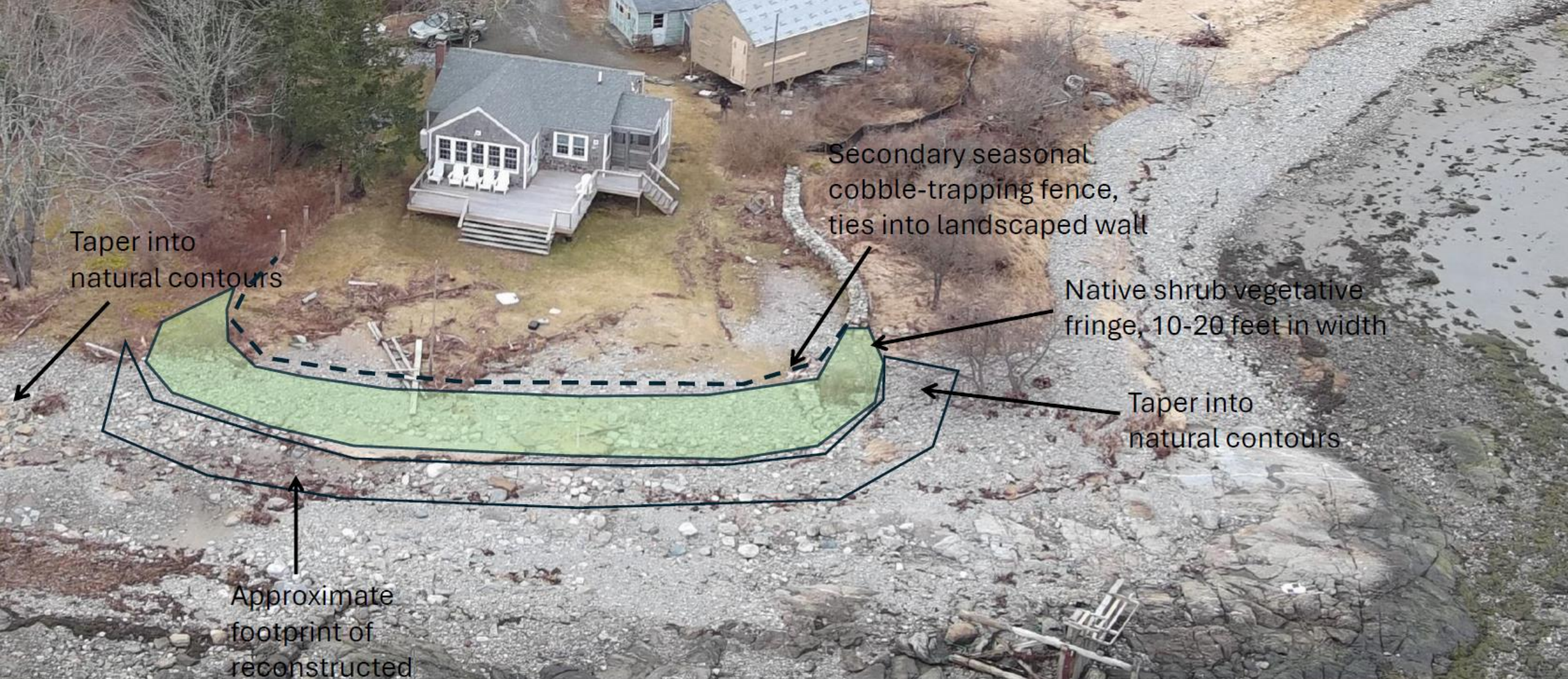
March 2024

Richards, Cranston & Chapman, LLC
 56 Kimberly Dr, Rockport, ME 04856 (207) 594-4414

Drawing Notes:
 The elements of this drawing are from field measurements and drone photogrammetry photos taken on 3-6-24, Maine GIS published Lidar and a Real Estate Boundary Survey drawn for Robert Vannoy and Rachel Means by F.E. Beal Surveying Company in April 2017. The purpose of this drawing is to display the proposed improvements for permitting purposes.

Original proposal
 Vertical wall comprised of a reinforced concrete center and pinned field stones.





Solution: MGS suggested a restored a cobble dune using larger (D75) field stones as a “core” that tapered into natural contours on the site, and shrub plantings and a cobble trapping fence landward.

Permits: Maine DEP Individual Permit (but could be permitted under PBR now)

Cost: less than full rip-rap proposal

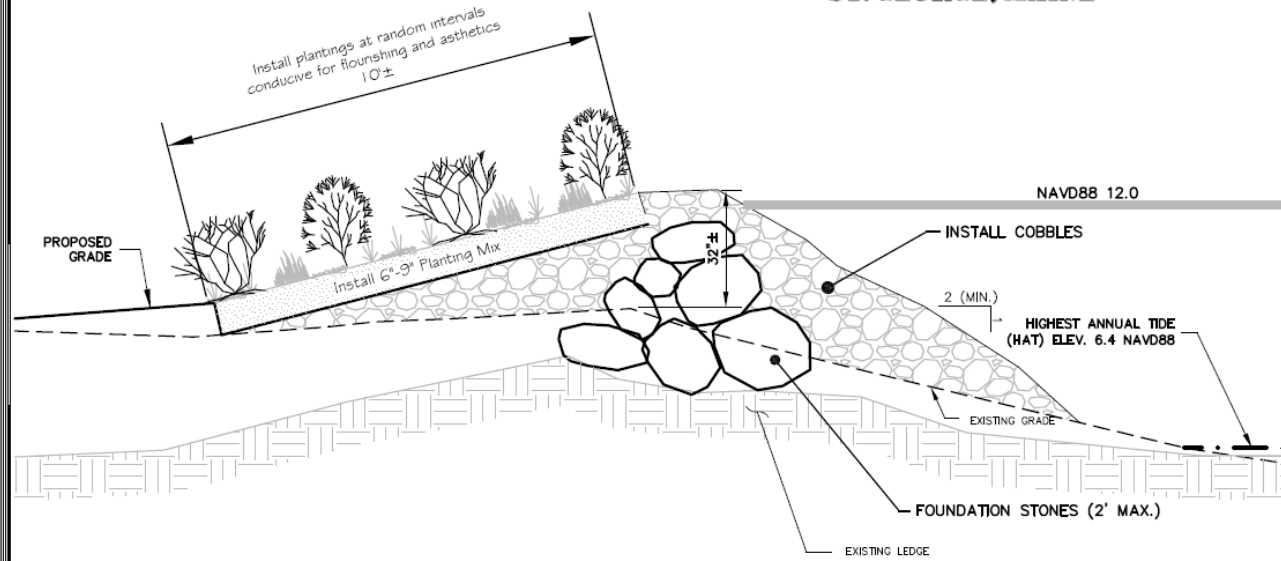
Monitoring: 85% vegetation planting success for several years.

Typical Section

VANNOY SHORELINE STABILIZATION

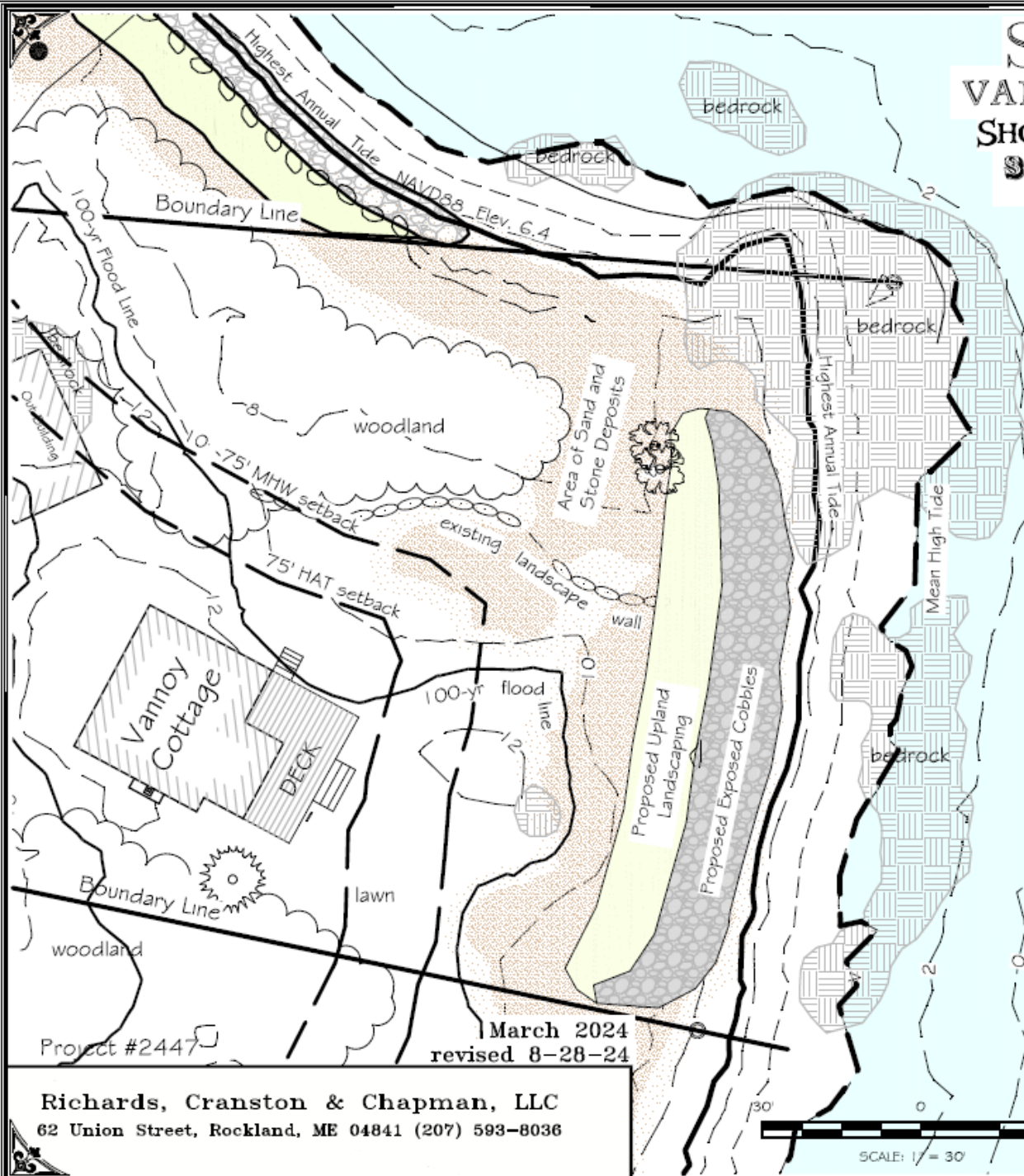
MOSQUITO HARBOR

ST. GEORGE, MAINE



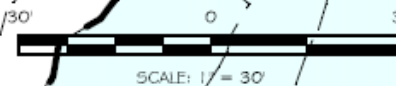
Project #2447 April 2024 (revised 8-28-24)

Richards, Cranston & Chapman, LLC
62 Union St., Rockland, ME 04841 (207) 593-8036



Project #2447 March 2024 revised 8-28-24

Richards, Cranston & Chapman, LLC
62 Union Street, Rockland, ME 04841 (207) 593-8036



Drawing Notes:

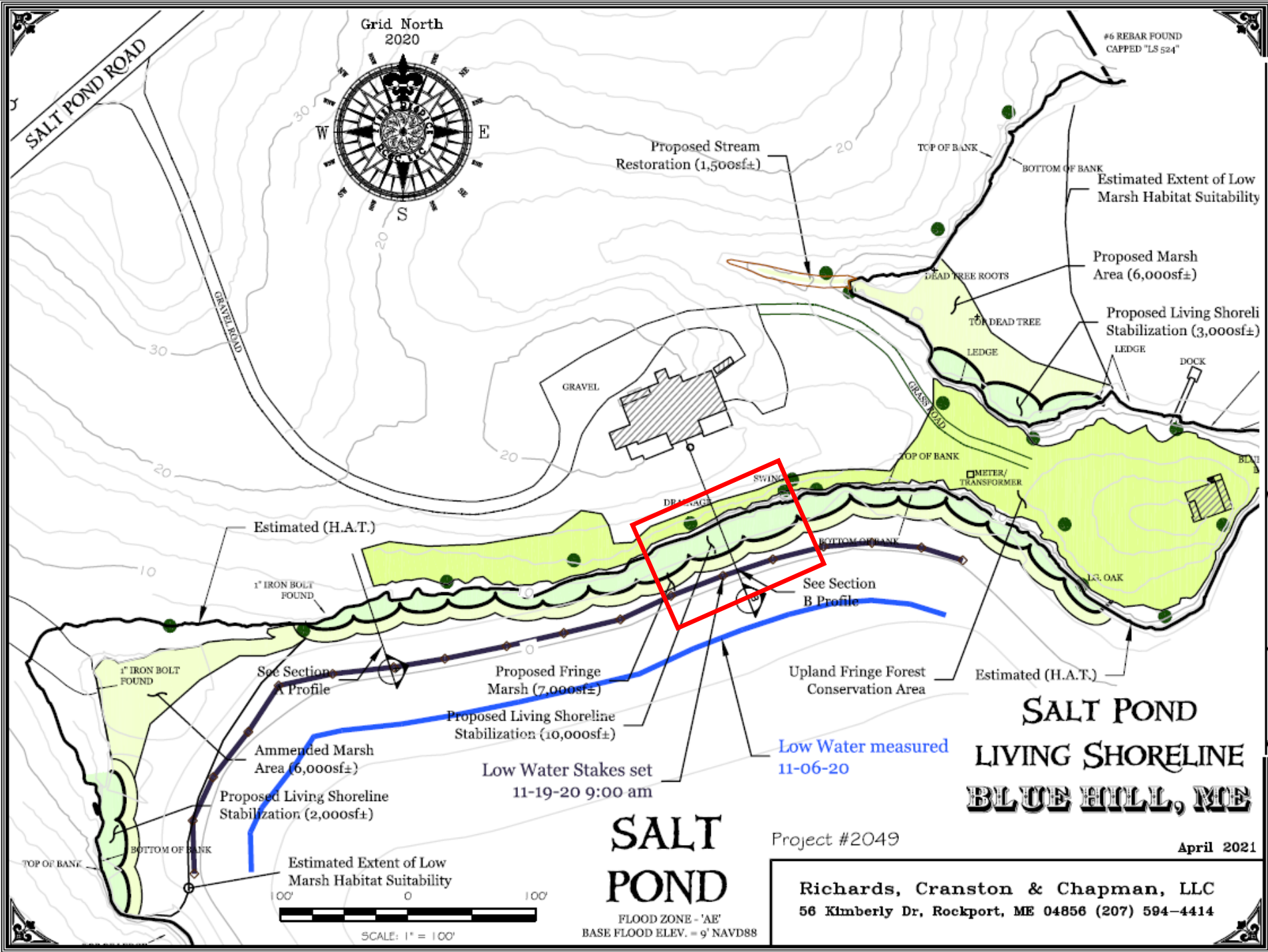
The elements of this drawing are from field measurements and drone photogrammetry photos taken on 3-6-24, Maine GIS published Lidar and a Real Estate Boundary Survey drawn for Robert Vannoy and Rachel Means by F.E. Beal Surveying Company in April 2017. The purpose of this drawing is to display the proposed improvements for permitting purposes.

Final proposal
Field stone-core dune
with natural cobbles
and a 10-foot wide
swath of native shrubs





Location: Salt Pond, Blue Hill
Problem: eroding and undermined bluffs, falling trees, poor upland land management



Solution: a tiered living shoreline design that included marsh restoration, tidal stream restoration, tiered habitats, and a tiered bluff that beneficially reused fallen and hazard trees.

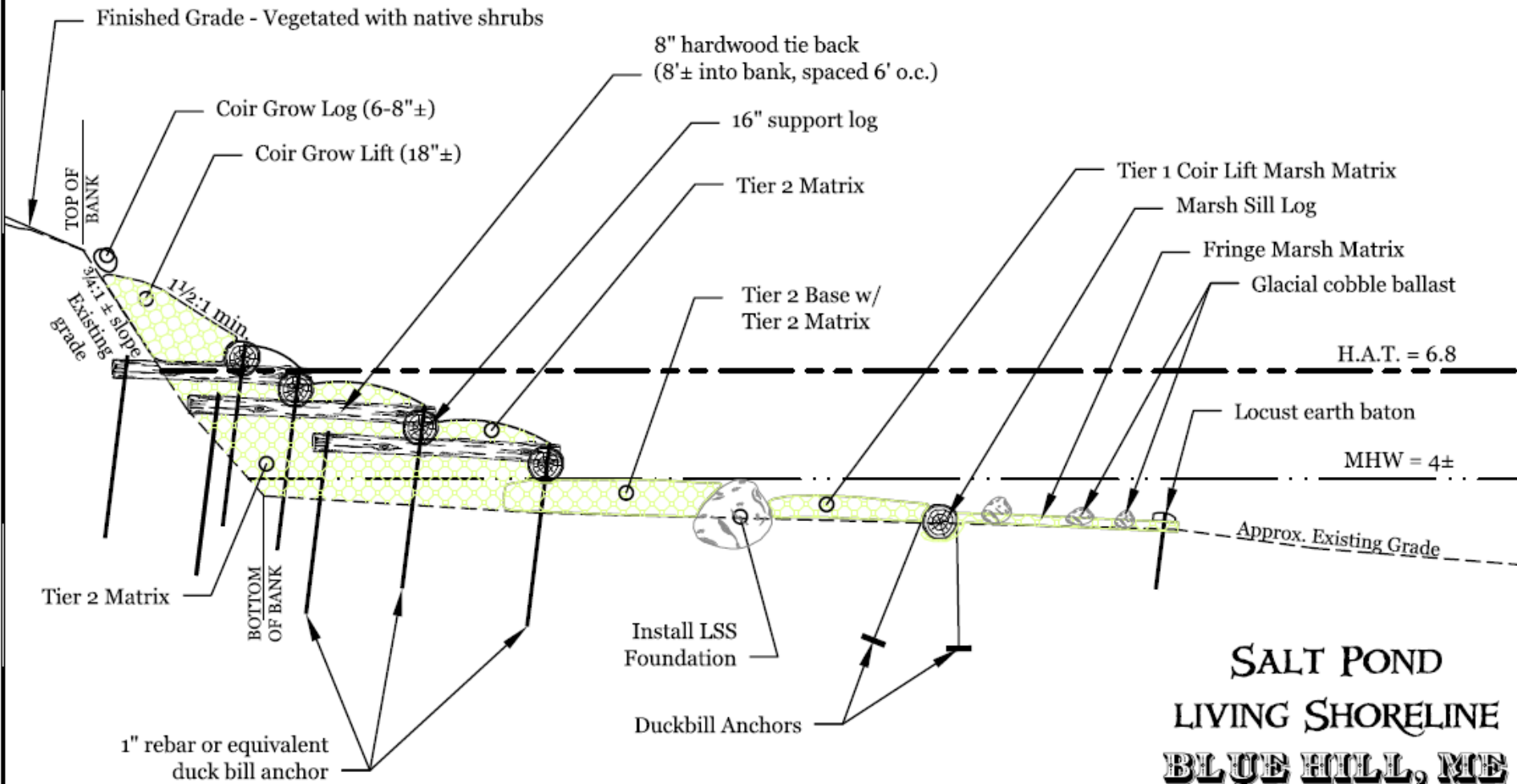
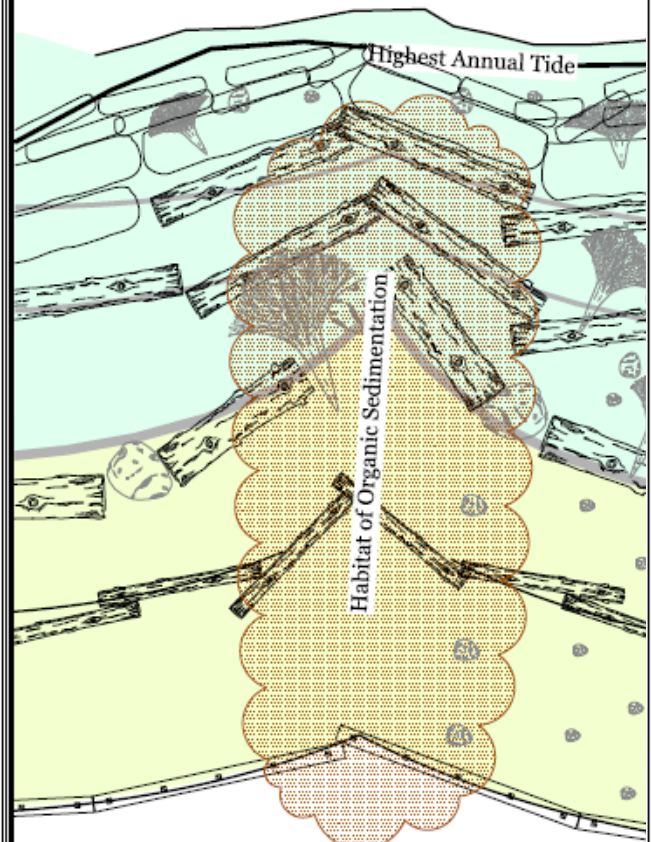
Permits: USACE Individual Permit, MEDEP Individual Permit (marsh restoration offset any coastal wetland fill requirements)

Cost: comparable to rip-rap shoreline

Monitoring: 5 years, annual surveys of vegetative plantings



NORRIS UPLAND



SALT POND LIVING SHORELINE BLUE HILL, ME

SALT POND LIVING SHORELINE BLUE HILL, ME



Project #2049

February 2021

Richards, Cranston & Chapman, LLC
56 Kimberly Dr, Rockport, ME 04856 (207) 594-4411





4/2024

Sat Pond Rd

172

Stream restoration, fringe marsh, regraded and planted bluff

Image © 2025 Airbus

Imagery Date: 4/21/2024 44°21'30.81" N 68°34'41.11" W elev 48 ft eye alt 104



1985



Stream restoration

Marsh restoration to tiered bluff

Marsh restoration to tiered bluff

P. Slovinsky, MGS

Stream restoration and marsh restoration to tiered bluff





4/2024

Sail Pond Rd

172

Marsh restoration
transitioning to
tiered bluff

Image © 2025 Airbus

Google Earth



Imagery Date: 4/21/2024 44°21'30.81" N 68°34'41.11" W elev 48 ft eye alt 104

1985



P. Slovinsky, MGS

Marsh restoration to tiered bluff





P. Slovinsky, MGS

Marsh restoration to tiered bluff





Coastal Bluffs Resources (CCSWCD)

<https://www.cumberlandswcd.org/documents-1/coastal-bluffs>

Coastal Property Owner's Guide (MGS)

https://digitalmaine.com/mgs_publications/605/

Living Shoreline Decision Support Tool (MGS)

https://www.maine.gov/dacf/mgs/hazards/living_shoreline/index.shtml

Living Shorelines in New England (TNC)

<https://www.conservationgateway.org/ConservationPractices/Marine/Pages/new-england-living-shorelines.aspx>

Living Shoreline Pilot Project Case Studies (TNC)

<https://www.nature.org/en-us/what-we-do/our-priorities/protect-water-and-land/land-and-water-stories/northeast-living-shorelines/>

Thank you!



Getting Out of Harm's Way

Jessica Brunacini, PhD

Coastal Training Program Director
Wells National Estuarine Research Reserve

Spectrum of Nature-Based Strategies



Strategy	Protect	Accommodate	Avoid	Retreat
Example Approach	Building an engineered dune to keep water away from homes	Elevating buildings and infrastructure to allow higher water levels to pass through	Putting land into conservation to prevent new development or redevelopment in increasingly hazardous areas	Relocating critical infrastructure to higher ground to prevent inundation



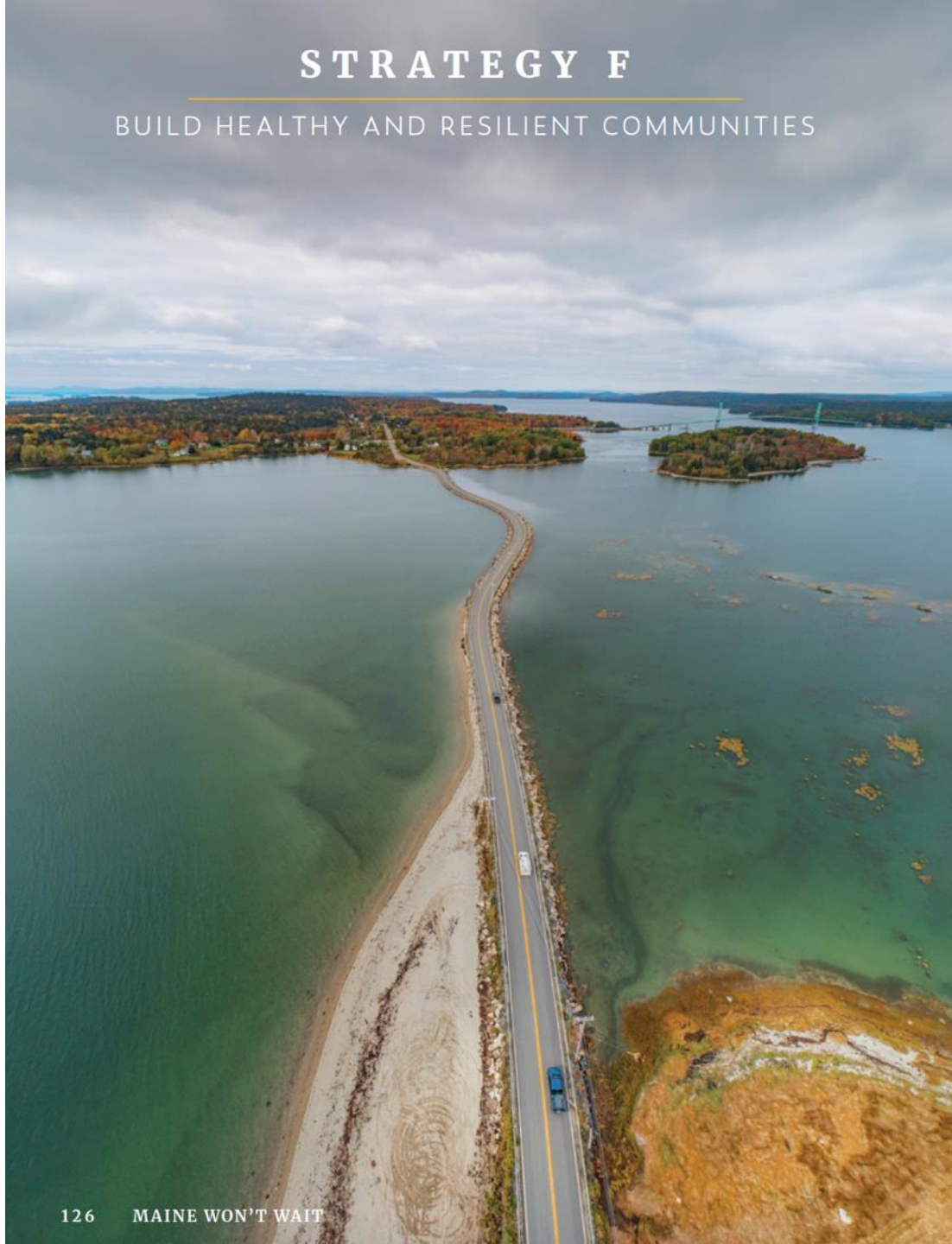
A Quick Note About Language of Retreat

- Retreat
 - *Managed* Retreat
- Relocation
 - *Proactive* or *Planned* Relocation
 - *Community-Driven* or *Community-Led* Relocation
- Realignment
- Site Expansion
- Climate Migration
- Resettlement
- Getting out of harm's way

Maine Won't Wait Climate Action Plan Update

STRATEGY F

BUILD HEALTHY AND RESILIENT COMMUNITIES



1

Increase local capacity for climate resilience

- Expand investment in grants and assistance to communities, so that by 2030, 80 percent of Maine communities are enrolled in the Community Resilience Partnership (CRP) and have received grants through the CRP or the Maine Infrastructure Adaptation Fund (MIAF).
- Help communities strengthen communication networks before, during, and after disasters, especially for people who traditional channels may not reach.
- Develop and share guidance with communities to help reduce the risks to development in areas vulnerable to wildfire, severe storms, extreme heat and cold, or other climate-related hazards, including tools to help communities and people "get out of harm's way."
- Increase local and regional capacity for management of storm debris and household hazardous wastes.

Oakwood Beach,
Staten Island:
Pre-Superstorm
Sandy



Oakwood Beach,
Staten Island:
Post-Retreat



Dead ends in future for hazardous road that now crosses Spurwink Marsh

Cape Elizabeth and Scarborough plan to remove the portion of Sawyer Road/Sawyer Street that routinely floods during storms and is damaging marsh habitat.



Image credit:
Matt Craig

Wiscasset Approves Funds for First Phase of Wastewater Treatment Plant Relocation

December 8, 2024 at 8:00 am

Molly Rains



Wiscasset residents vote to allocate \$353,750 from fund balance as a grant match toward phase one of the town's wastewater treatment plant relocation project during a special town meeting on Tuesday, Dec. 3.
(Molly Rains photo)



Credit: Seth Wenig / AP Photo

Property Buyouts

Voluntary

Funded by federal agencies, administered through states

FEMA, HUD, NRCS grant programs

Mix of post-disaster and pre-disaster programs

Homeowner's primary residence

Land returned to natural, open space in perpetuity

FEMA's Hazard Mitigation Assistance Grant Programs

Property Buyouts: Step-by-Step



April 2020

After a presidentially declared disaster, local officials may request money from the state to purchase properties that have either flooded or been determined substantially damaged by the local floodplain manager. Since 1989, FEMA has acquired more than 43,000 flood-prone properties.

The buyout acquisition cycle is about 18 to 24 months. **On average, it takes FEMA approximately 4 months to approve the acquisition project once the state requests funding.**

This is a long-term effort, requiring multiple decisions at each step.

For more information about property buyouts under FEMA's Hazard Mitigation Assistance Grant Programs (HMGP, BRIC, and FMA), visit www.fema.gov/hazard-mitigation-assistance or contact your local or state emergency management officials. All HMA programs are voluntary programs.

HMA Program Cost Sharing Requirements (Federal/Non-Federal Share)

Hazard Mitigation Grant Program: 75/25
 Pre-Disaster Mitigation: 75/25
 Flood Mitigation Assistance: 75/25
 FMA repetitive loss: 90/10
 FMA severe repetitive loss: 100/0



Step 1

Property Owner:
Experiences damage and is interested in selling their property to the government. The property owner contacts the local municipality to discuss options.

Learn more at: www.fema.gov/state-hazard-mitigation-officers

0 Months

Compliance with all local ordinances is required if any rebuilding work is undertaken after the disaster.



Step 2

Local Government:
Considers the option and decides:

- ✓ To purchase properties with local funds
- ✓ To apply to the state for funds
- ✗ To not acquire the property

Time is national here

PROCESS MAY STOP HERE FOR LOCAL GOVERNMENT REVIEW



Step 3

State Government:
If the local government makes a request for funds, the state considers the request and decides to:

- ✓ Apply to FEMA for the funds to purchase the property
- ✓ Identify funding from another source to complete the project
- ✗ Not to use grant funds for the requested property purchase

On average, nationally, states take 15.5 months after a disaster declaration to submit acquisition projects to FEMA.

If requesting funding through the HMGP program, applications are due 12 months from date of declaration but can take up to 18 months due to two potential 90-day extensions.

Process may take ≈ 12 - 18 months

PROCESS MAY STOP HERE FOR APPLICATION REVIEW AND APPROVAL



Step 4

Federal Government:
If the state makes a request, FEMA accepts and reviews the application to ensure it meets requirements. If requirements are met and funding is available, the grant is awarded. Requirements include:

- ✓ Completeness
- ✓ Eligibility
- ✓ Technical feasibility
- ✓ Cost effectiveness
- ✓ Compliance with environmental planning & historic preservation requirements
- ✓ Local cost share is provided
- ✓ Under the Flood Mitigation Assistance grant program, the repetitive loss (RL) properties and severe repetitive loss (SRL) properties have a 90:10 or 0 Non-Federal cost share.

FEMA takes ≈ 4 months to approve acquisition projects

If requirements are met and funding is available, the grant is awarded.



Step 5

State Government:

Issuance of State/Local Agreement
The next step is the issuance of the state/local agreement, which clearly defines the parameters of the implementation of the project. From there, local government can begin the implementation of the acquisition project.

On average, nationally:
• States take **15.5 months** after a disaster declaration to submit acquisition projects to FEMA.
• FEMA takes **4 months** to approve acquisition projects.

Project Award



Step 6

Local Government:
Once the implementation is approved, the final step is to begin the acquisition project. To complete the acquisition, the local government needs to:

- ✓ Offer a pre-disaster fair-market value
- ✓ Conclude the appeals process for homeowners who disagree with appraisal value
- ✓ Pay the remaining mortgage balance paid to the lienholder
- ✓ Demolish the structure
- ✓ Deed the land to the local government with its use restricted to open space

Almost **80%** of acquisitions are approved in under two years and **93%** are approved in three years or less.

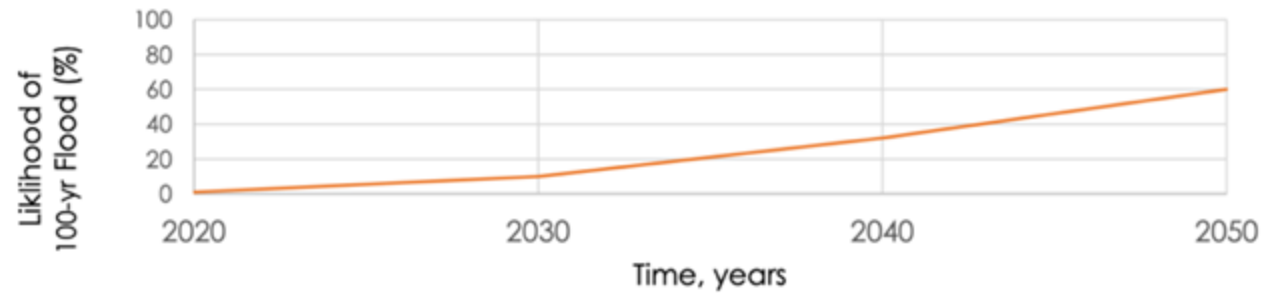
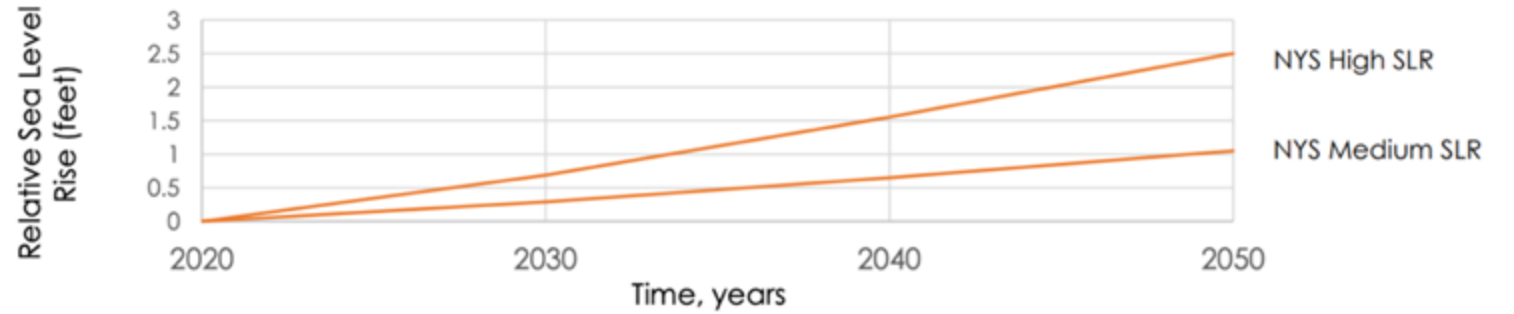
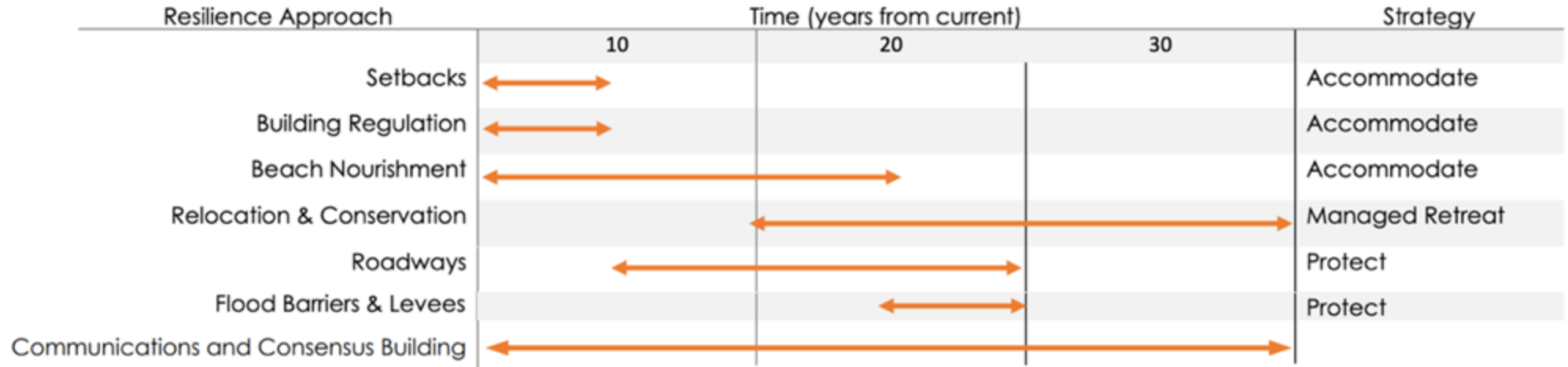
Project Completion

Reference Table
 ✓ Process continues
 ✗ Process ends

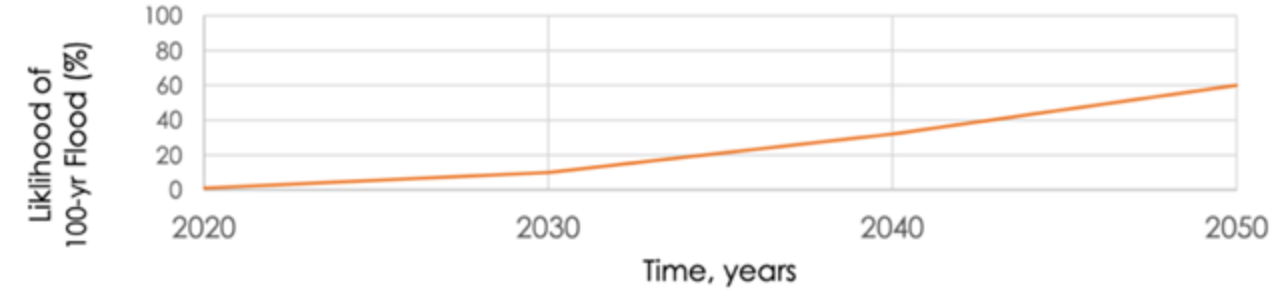
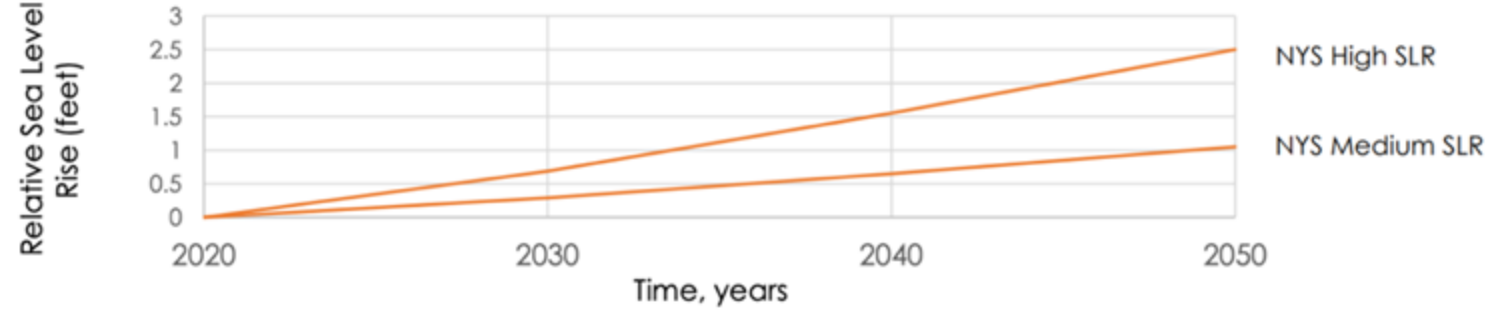
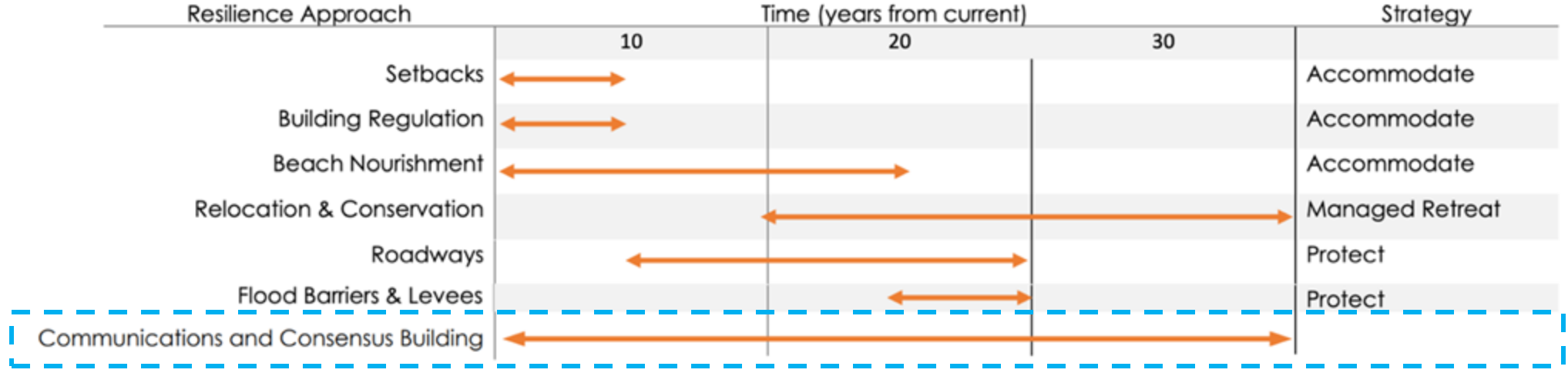
Maine Won't Wait Climate Action Plan Update Strategy F: Build Healthy and Resilient Communities

“Other potential tools could include a **voluntary “buyout” program** that pays property owners the market value of their property so they can move to a safer location when they decide that options like insurance or adapting in place no longer make sense. Such a program needs to **balance risk reduction with other potential local concerns** such as identifying safer areas, maintaining the sense of community, ensuring sufficient affordable housing, and impacts to municipal budgets.” – pg. 131

Town of East Hampton, NY Resilience Timeline

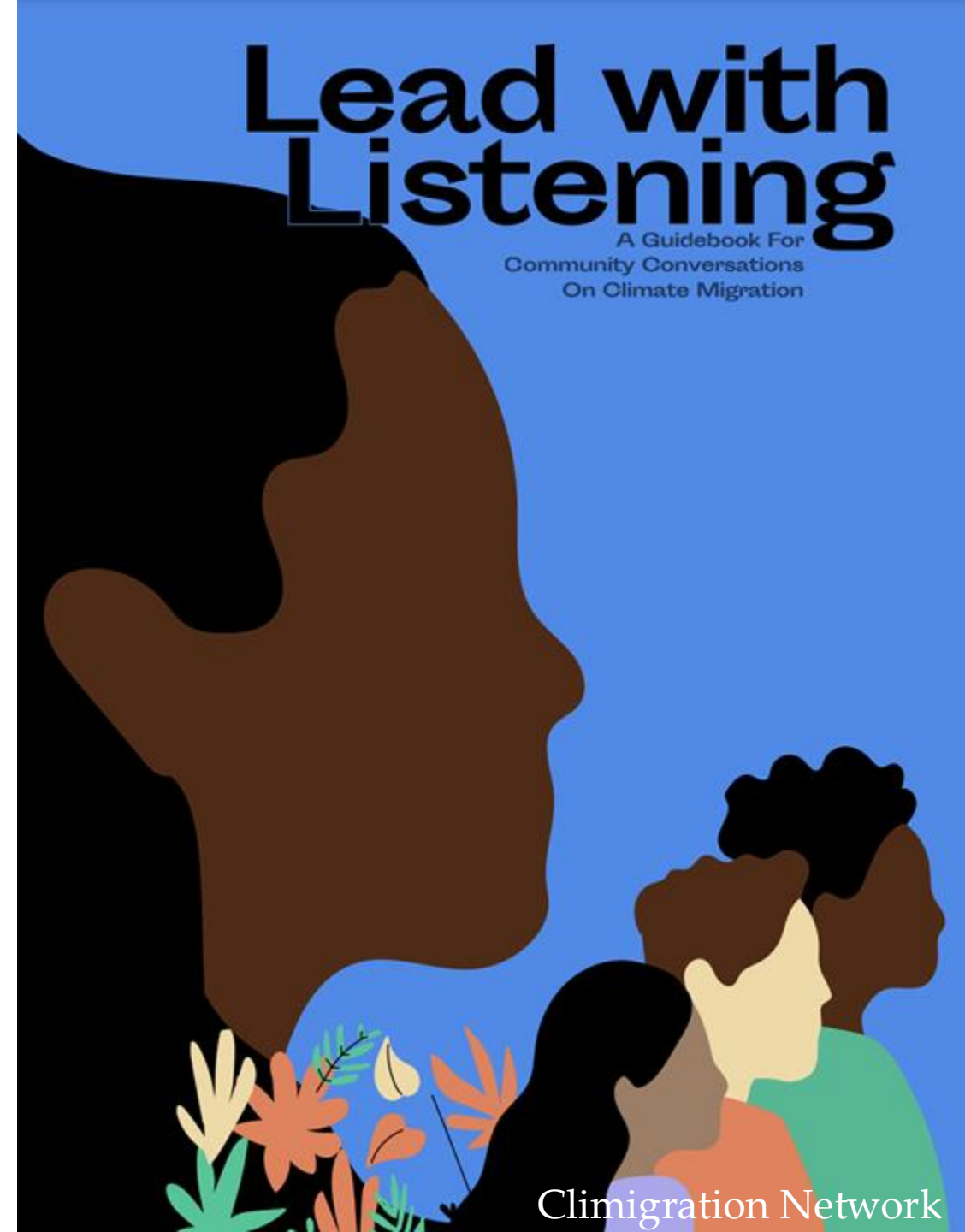


Town of East Hampton, NY Resilience Timeline



How do we talk about this?

- Center community members as experts
- Earn trust
- Consider culture, not just buildings
- Acknowledge trauma
- Speak to fear and anxiety
- Recognize power structures
- Use language that speaks to people's everyday lives



Who would lead these difficult conversations in Maine?

- Community leaders
- Engagement practitioners
- Facilitation experts
- Mental health professionals
- Social scientists

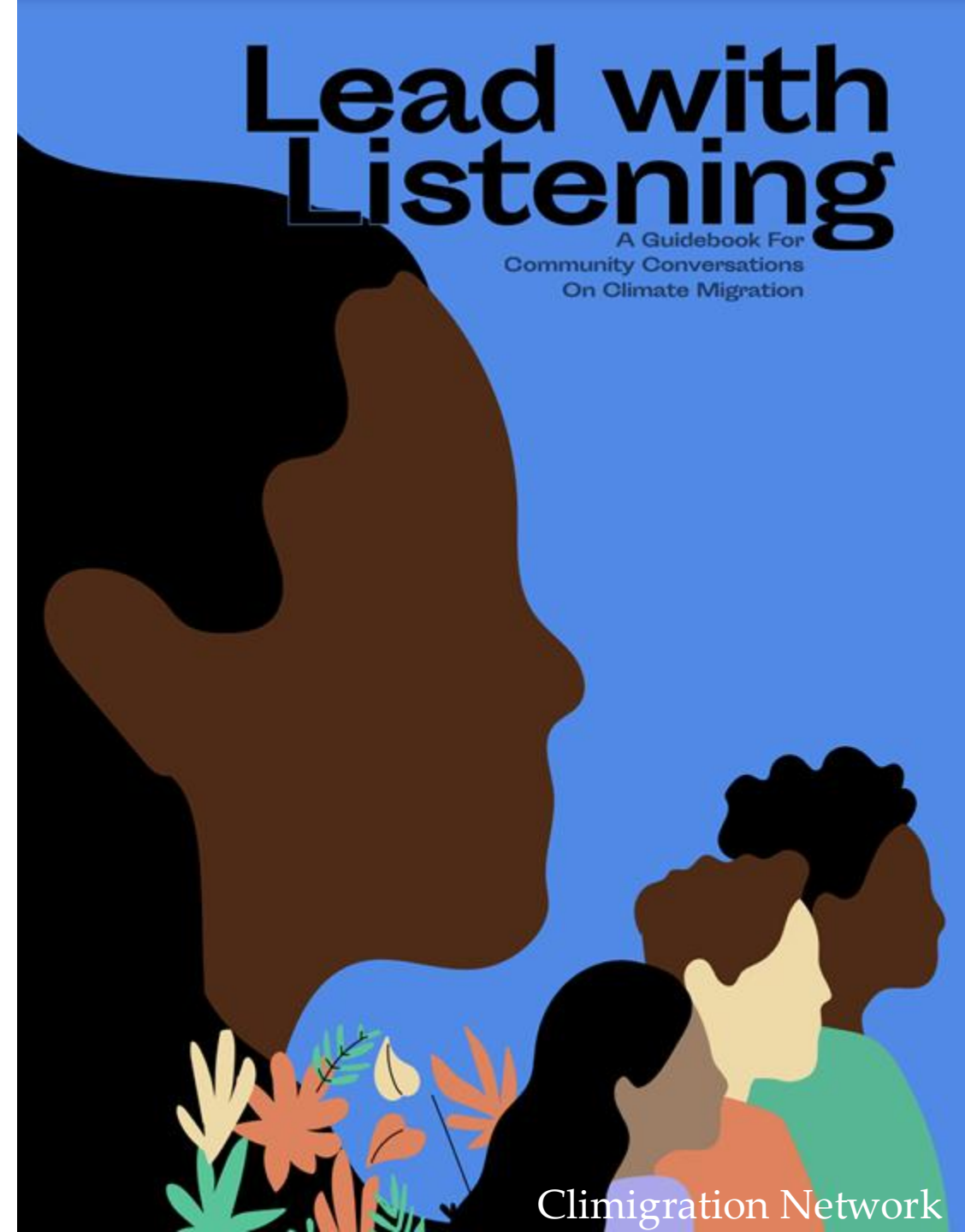




Image credit:
Alex MacLean

Thanks so much, and please feel free to reach out!

Jessica Brunacini, PhD

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Wells National Estuarine Research Reserve

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